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PROCEEDINGS OF SOCIETIES.

PROCEEDINGS OF THE KANSAS ACADEMY OF SCIENCE: 13th ANNUAL MEETING.

REPORTED BY PROF. J. D. PARKER.

The Kansas Academy convened in Topeka on Thursday, November 11th, and held a business meeting in Dr. Thompson's office at 3 o'clock. There was a good attendance of the scientific men of the State; also quite a number from Missouri. Although the Academy has met with severe loss in the death of Professors Mudge, Fraser, Bardwell and Kedzie, their mantles have fallen upon others, who come forward with alacrity to fill their places. The following officers for the ensuing year were elected: President, J. T. Lovewell of Topeka; first vice-president, Jos. Savage of Lawrence; second vice-president, J. H. Carruth of Lawrence; secretary, E. A. Popenoe of Manhattan, and treasurer, R. J. Brown of Leavenworth.

The collections of the Academy have grown to such an extent that a committee was appointed to secure a separate room for them in the new Capitol building. Fifty dollars were voted from the funds of the society to the Mudge Memorial Fund, and a committee was appointed to superintend the erection of the monument. Mr. Joseph Savage made a report in reference to the fund, indicating that a general interest all over the country has been taken in doing honor to this distinguished geologist. The Academy resolved to take up the geological survey of the State, and appointed a committee to memorialize the legislature on this subject.

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The Academy met in the Hall ofRepresentatives in the evening at 7:30 o'clock, and listened to a lecture by President Fairchild, of the Kansas Agricultural College, entitled "Science in Every Day Life," of which we can give at present but a brief abstract. The lecturer did not claim to be a specialist in science. He, however, showed that he was thoroughly familiar with the workings and achievements of science, and took up the various departments of life and showed what great benefits had been conferred upon the world through this means. Science has conferred great benefits upon commerce. The ocean, full of dangers, has become through science the safest and cheapest of thoroughfares. Science has not only warned navigators of danger, but has removed them. Even Hell Gate has not prevailed, the Mississippi has opened her mouths to commerce, and the Alps have been tunneled. Science has made war terrible, and thus reduced its victims. The range of art has increased indefinitely. Men use the results of science without being thoroughly acquainted with theoretical science, and some enjoy the blessings without acknowledgment to those who confer them. All forms of industry have been aided by science, and the lecturer gave many examples, instancing the farmer, manufacturer, etc. In farming, men were getting out of the mere rut of imitation, and by applying science were now on the highway of progress. In our homes, science is testing the food we eat, the water we drink, and the air we breathe. Science finds "death in the pot," where men least expect it. Science discovers poisons in various directions and warns men of the danger. Science has done much in the way of giving us the necessaries of life and has bestowed upon us many of our luxuries. The day of mere muscle among the nations has passed, and the day of mind has dawned. The powers of men are developed and enlarged, and they have acquired skill. All labor becomes ennobled as it uses mind and involves thought. The American watchmaker excels the Swiss watchmaker, not in greater skill, but in superior knowledge of general principles.

Our morals touch, also, on the principles of physical science, and moral teachers must understand these. Wisdom does not consist simply in knowing facts, but in knowing the bearing relations of facts. Men must learn to receive sensations without bias, and interpret them aright. A true interpretation of the principles of nature is the basis of wise living.

But science reaches beyond mere physical forces and touches the infinite, and true science leads us to know and honor the Cause of all things. Science exalts many lines of drudgery into callings that are noble and useful. The progress of the world is in the line of its wants. The growth of invention has followed the growth of our wants. The sounds of the telephone were first heard from a bath tub. From the time that Adam and Eve learned that they needed clothing scientific skill has been supplying our wants.

An accurate science is the greatest stimulus to real progress. The cultivated races meet their own wants the best, and supply something for other races. The man or race whose wants increase more and more every year are on the highway

to immortality. The masses of mankind reap the benefits of science in spite of themselves. The lecturer believed that most of the strictly scientific truths would always find their way through the world by experience and life as one jostles against another. Science maintained at the expense of the world returns a hundred fold.

The whole lecture was replete with facts which no synopsis can reproduce, and was received with great interest by the audience.

At 9 o'clock, Friday, the Academy convened in the Senate chamber and the following papers were read: The Judith River Group, by Charles Sternberg. This was an original and valuable paper. Tornadoes, by John D. Parker. The Irving Tornado swept over a large extent of country, displaying seven or eight funnels along its course. The author preferred to make the term tornado comprehensive enough to embrace the whole storm, including all the funnels, instead of making several tornadoes. The paper advocated the thermal theory. Artificial Propagation of Food Fishes, by D. B. Long. The author of this paper spoke of the processes for the artificial propagation of fishes, and gave a list of those food fishes which are best adapted to Kansas. The preliminary List of the Reptiles of Kansas, by Frank W. Cragin. This was the first contribution to this department of science in Kansas and showed original work. Traces of the Aborigines in Riley county, by Prof. G. H. Failyer. Archæology has become one of the most interesting of all branches of natural science, and the author of this paper has collected considerable material which was of absorbing interest to the members of the Academy. The paper was characterized by the presentation of facts more than theories. The Burlington Gravel Beds, by Robert Gillham. Since the discovery of the Burlington gravel beds, ten years ago, they have become pretty well known. The beds are probably the result of modified drift. No better material for macadamizing streets can be found than this beautiful chert, which possesses all the characteristics for such purposes. Mr. Gillham is a practical engineer in Kansas City, and he went down to Burlington professionally to examine the beds. His report is as favorable as could be desired, and this gravel will now probably come into more general use as a macadam. The morning session was well attended and of unusual interest. The papers were thoroughly discussed by the members, and the Academy is evidently increasing in members and power. The Academy is doing a large amount of original work from year to year, and the results have already become known throughout the scientific world.

At the afternoon session a large number of commissioners were appointed for the coming year, covering the whole field of science.

Dr. John Fee, of Kansas City, then read an important paper on Color-blindness, based on original observation. The paper discussed the various theories of color-blindness and found them unsatisfactory. The most probable cause of color-blindness is a congenital defect. The paper then considered the relation of this subject to railroad accidents. Railroad employees sometimes cannot distin-

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guish colors in lights used for signals, hence railroad accidents. Dr. Fee illustrated his paper by worsteds, used for Holmgren's tests of the various colors, and held that railroads should examine their employees in regard to this matter. He hoped Kansas would, by legislative action, cause such examinations to be made, and thus follow the example of some of the eastern States.

Professor Snow then read a paper giving "Additions to the Catalogue of Kansas Lepidoptera." One hundred species have been determined during the year.

Professor Parker read a memorial paper of Professor Mudge, giving a brief narrative of his life and labors. Professor Mudge was the first president of the Kansas Academy of Science, and was president when he died. During all the twelve years he was connected with the Academy, he was indefatigable in his labors for its success. His papers are all based on original observation and experiment, and are most valuable contributions to science. He discovered the *ichthyornis dispar*, or the bird having teeth, which is now kept for safety in a fire proof safe, being the only specimen ever discovered. He discovered the so-called bird tracks in the Osage valley, which would have made a reputation for any geologist. On the day of his death he spoke of eighty new species which he had discovered, many of which bear his name, and it is probable he discovered many more, as Professor Mudge was very modest in speaking of his own labors, although he was always prompt in noticing the labors of others.

Professor Mudge possessed personal qualities which made him a valuable friend and neighbor. He was loved by all his pupils and by his neighbors: a sure test of a good man. He died at his home, November 21, 1879, of apoplexy. Scientific men from various portions of the State and from other States were present at his funeral to aid in doing honor to him who had done so much for the New West. Although Professor Mudge never claimed the honor of originating the Kansas Academy of Science, and in his report on the organization of the society published in the Transactions of the Academy for 1870, gave this honor to another, yet he was the first and last president of the Academy, and his services to the society were invaluable. As long as science has a votary in the great central plains of the North American continent, Professor Mudge will not be forgotten.

Mr. Joseph Savage then read an interesting paper on Concretionary Forms, which was amply illustrated by specimens from all portions of the State.

Professor Lovewell next read a paper on Weather Observations in Kansas. The Professor has recently inaugurated a system of State meteorological observations, similar to those of Professor Nipher in Missouri, and of Professor Hinrichs in Iowa, and has enlisted in its behalf a large number of observers at various points. He expects shortly to have reports from every county in the State. The object of this paper was to indicate the general scope and purpose of the Kansas Weather Service.

Mr. Eli H. Chandler, of Topeka, discussed in an illustrated paper the Feldspar Groups of Minerals. The paper was a contribution based on original

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observations. Professor Snow then read a paper on "The Last New Kansas Bird." Since the last meeting only one species has been discovered. This makes 303 species known in Kansas. This bird is the Ibis. In Egypt the sacred Ibis was embalmed and formed in ancient times an object of worship. The specimen was taken near Lawrence by Mr. W. S. Bullene. Professor Snow thinks there may be twenty-five or thirty species of birds in Kansas not yet discovered, and wishes to learn of any new bird that may be found. A preliminary list of reptiles of Kansas was read by F. M. Crozier. The author enumerates eighty-seven species, including twelve species of tortoise, thirteen of lizards, forty-two of harmless snakes, five of salamanders, and five of poisonous snakes. Among the latter the copperhead has been found in a few counties. This paper formed an important contribution to this branch of science.

Judge Adams discussed Irrigation. He said the papers had all been on dry subjects; he would read on a wet one. The paper gave original observations and valuable suggestions. The paper referred more particularly to irrigation in Western Kansas, to Sequoyah county, and counties lying round about. It would pay the State of Kansas to make a careful survey of those portions of the State that need irrigation.

Mr. H. R. Hilton, of Topeka, read a paper on Rainfall in its Relation to Kansas Farming. The paper discussed the different soils of the State and their power of absorbing moisture. When Kansas was first settled it was thought the State could not be cultivated west of Topeka except along the valleys. Now good crops are raised 300 miles west of the east line of the State. Cultivation, planting forests, stopping devastating prairie fires, and a change of grasses, with mulching have been the principal means of these great changes.

A dry stratum of air near the earth prevents precipitation of moisture, and the storms have a tendency to pass over us. Storms have become less violent and more general. The changes going on have tended to establish a connection between the earth and the clouds. We must prevent radiation and increase deposition of moisture. As an evidence that our former dry climate is passing away, the mirage formerly so common, and a result of a dry climate, is now seldom seen. Western Kansas may never have as much rain as Eastern Kansas, but the soil does not require it. In Western Kansas wheat can be surely raised three years out of four. Stock should be raised in Western Kansas, and farmers should learn to plow deep. The author believed that Kansas can, by applied science, be made one of the best agricultural States in the Union.

A very large audience gathered in the senate chamber in the evening and Professor Lovewell gave a lecture on "Science in the Common Schools." The lecturer gave a brief survey of science instruction in the schools he had been connected with for the twenty-five years during which he had been a teacher. Twenty-five years ago, science was subordinated to the classics and other studies. The programme of school studies was left very much to the teacher. Botany was taught by ladies, and boys were not expected to study botany any more than

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they would embroidery. Pupils were never allowed to see how experiments were prepared. When Agassiz came over there was a great change, as indicated by such schools of science as the Sheffield school, at Yale, and the Chandler school, at Harvard. The lecturer gave some recent personal observations of science teaching in the East. He spoke of science literature. Harpers' science department was read and relished as much as any other department of the magazine. The leading journals now are called upon to furnish scientific literature, edited by men trained in this department. The teaching in our public schools has changed very much in twenty five years and science is gaining ground.

The lecturer then considered how science is taught in our schools. The methods are very much improved, still there is too much of books and too little of nature. There is a lack of originality. The grades have been an obstruction. Public schools have too much of statistics and too little of apparatus. The laboratory of public schools is often a rubbish room. Specimens have been considered as mere curiosities. Teachers need to be trained to scientific methods. The laboratory should be a place of work and investigation. Two things have worked against the study of science. Experiments cost something and science requires hard study. There are many means of scientific illustration in every day life in manufactories. Professors in our schools have often been on the best terms with the superintendents of manufactories, realizing that they often furnish the best illustrations of scientific processes. The lecture concluded with valuable suggestions in reference to the improvement of our schools in teaching science. The votaries, however, in looking over results, can thank God and take courage.

Col. Theo. S. Case was then introduced and delivered his lecture on the ancient city of Pecos, New Mexico. This lecture was recently delivered in Kansas City where, as well as at Topeka, it was well received.

The Academy met in the Senate chamber on Saturday morning, the abundance of material furnished in the programme, overflowing the limit of two days. Mr. B. B. Smyth, of Great Bend, read a paper on The Plants of Central and Southwestern Kansas. The paper was illustrated with a beautiful herbarium of the plants described. The author said he had traced the roots of the *Amorpha canescens* twenty-six feet deep in the ground, where they were uncovered in digging a well. The paper showed original work.

Professor Sadler, of Emporia, was called upon to explain a pinch-cock, with a tangent screw, which he had invented to aid in chemical manipulation. With this ingenious device half a drop can be obtained in a given time, a supply very satisfactory in laboratory processes.

Mr. D. C. Tillotson, of North Topeka, read an interesting paper on "Fragments of Pottery on the Upper Solomon." Some of the pottery was found in a mound partly washed away, and was attributed to the Mound-builders, and some of the pottery to the Indians.

Mr. J. C, Cooper gave, by invitation of the president, a narrative of his

observations relative to some Mineral Formations in Colorado. He spoke particularly of the natural processes by which minerals have been deposited; and favored the theory of infiltration, by which minerals have been deposited from solution. Minerals may have also been deposited by vaporous action from below. The processes of mineral deposition were so various that he thought it was safer not to be too positive in our theories.

President Lovewell gave a narrative of a visit to the laboratory of the medical college of Harvard University, and of some new and very interesting experiments with the platysmagraph. This ingenious instrument shows the influence of the mind on the muscles.

A student had said he could translate Latin and Greek with equal facility, but the instrument showed that the translation of Greek affected the muscles the more.

Professor Snow read a paper making valuable additions to our knowledge of the Coleoptera of Kansas.

Prof. G. H. Failyer read a paper, with illustrations, on the Skeleton of an Elephant found near Manhattan.

Mr. Savage read a paper on Some Implements found in Trego county.

Judge Adams read a paper on Science Teaching in common schools. This paper contained many most excellent suggestions. The author claimed that more science should be taught in our public schools.

Professor Carruth read a paper making valuable additions to the plants of Kansas.

Several papers were not read for want of time, but will be printed in the Transactions of the Academy.

The KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY was highly complimented by the president and several members of the Academy, and its editor elected an honorary member.

After the transaction of some routine business the Academy adjourned subject to the call of the executive committee.

ST. LOUIS ACADEMY OF SCIENCE.

A meeting of the Academy of Science was held November 15th at Polytechnic Hall, Mr. Albert Todd in the Chair and Professor Nipher acting as secretary.

Professor Nipher made a report on the proposition to change the place of meeting to Washington University, and stated that two large rooms could be secured in the third story of the old Academy building. The cases for the library will cost $175, and the furniture about $25. Owing to the absence of Dr. Engelman, the committee was granted further time to complete arrangements for the removal.

Corresponding Secretary Holmes read several letters, and presented a large number of publications received since the last meeting. He also spoke of

Dawkins' work on the Antiquity of Man, and concurred in the opinion that the race existed in the middle pliocene period.

Professor Nipher explained Bell's method of transmitting light, and showed by a diagram on the blackboard how rays of light may be made the medium of speech through the photophone.

There being no further business, the meeting adjourned until next month.

LEAVENWORTH ACADEMY OF SCIENCE.

The Academy of Science held its first meeting of the season at the Academy hall November 17, and was well attended. The lecture of the evening was by Judge Crozier, on "Chief Justice Marshall." The programme for the remainder of the season is as follows: December 16th, Dr. Tiffin Sinks, "A Visit to Rome illustrated;" January 13th, Dr. W. W. Backus, "An Old Egyptian Theory of Creation;" February 10th, Prof. F. A. Fitzpatrick, "Working of the Signal Service;" March 10th, Prof. W. W. Grant, "Utility the Test of Education;" April 7th, W. S. Burke, "Fossils;" May 5th, Dr. R. J. Brown, "Medicinal Plants of Kansas." There will be a meeting between every two of the above dates, when lectures will be delivered by parties from abroad who have agreed to speak, but were not prepared to give dates.

GEOGRAPHICAL NOTES.

MR. B. LEIGH SMITH'S ARCTIC EXPEDITION.

The following particulars of the voyage of the steam yacht Eira, of Peterhead, belonging to Mr. B. Leigh Smith, of London, to and from the Arctic regions, have been furnished the London *Times*. Mr. Smith, as is well known, has had considerable experience in Arctic navigation, and has done a great deal in the way of helping to clear up the mystery attaching to the unknown quarter of the globe near the North Pole. The Eira is a steam vessel of 350 tons gross, measuring 135 ft. in length by 25 ft. of beam. She sailed from Peterhead on the 19th of June, with a crew of 25, all told, including Mr. Leigh Smith, owner of the yacht; Mr. W. J. A. Grant, photographer; Dr. Neale, physician; and Captain W. Lofley, as ice master. The object of the expedition was to follow up the discoveries already made in the direction of the North Pole, and to obtain as high a latitude as circumstances would permit. After shipping the remainder of the crew at Lerwick, the Eira sailed on the 22d of June, and a week later reached Jan Mayen Island. They found the ice almost encircling the island—a somewhat rare occurrence at that late season of the year, as it is an unusual thing to

come up to the floes so far south. They anchored near Egg Island at 4 a. m. in nine fathoms of water. That morning Mr. Grant and others went ashore with the intention of collecting specimens and obtaining photographs of the place, but by noon they saw the ice drifting down and surrounding the ship, and thought it prudent to return on board. The ice continuing to come into the bay, they steamed away to the north-east, but were confronted by the main pack, which caused them to alter the course to a south-easterly direction to avoid being beset by the ice. On the 2d and 3d of July they got among the bladder-nosed seals, and shot over 300 of these animals. They followed the ridge of the main pack among loose ice until July 6th, when they made an attempt to reach the east coast of Greeland, near Cape Bismarck—the farthest point that the Germans reached. Land had been seen about 100 miles north of Cape Bismarck, and Mr. Leigh Smith's intention was to explore northward toward the point marked on the chart. They worked in toward the west until the 9th in 75 40 latitude; but the weather was foggy, and all the time the ice was getting closer and heavier, some of the floes met with being very large. On the 9th nothing could be seen from the crow's nest but ice closely packed, and the idea of going further west had to be given up. It was very discouraging to have to work their way back again; but it had to be done. They reached the open sea again on the 11th. On the evening of that date they sighted two whalers—the Eclipse and the Hope, of Peterhead. The three ships remained in company until the 13th, on the morning of which day the Eira was steered northward through loose ice. On the 16th they came upon block ice in 75 50 north latitude, and about 5 east longitude, and had to go eastward toward Cloven Point—a well-known landmark to the northwest of Spitzbergen. Passing that point they anchored to a floe of land ice off Welcome point on the 18th. The intention at this point was to steer north; but after more battling with the ice they had again to bout ship and make the best of their way to the open sea. It is mentioned as an unusual circumstance that the islands known as the Norways and Fair Haven were closed with ice. They anchored at the head of Smeerenburg Bay and took in water on the 20th; and, having sailed at once, were taken in a strong gale and had to seek shelter in Magdalen Bay. They lay there three days. The gale over, they sailed southward, and cleared the South Cape of Spitzbergen at midnight on the 30th of July, and next day came upon loose floating ice, which as they advanced, got much closer; and about 9 p. m., when within 24 miles of Hope Island, they had to take a southwesterly course to get clear of the ice. They reached a point 76 latitude and 25 longitude, and wanted to work northward after rounding the ice toward Wiches or King Charles Land, but finding this impossible, they took a northeasterly course with the idea of getting to Franz Josef Land. They reached the pack ice on the 6th of August in 77 14 latitude, and the course had again to be changed. Thence they continued in a northeasterly course, leaving the ice to the west, until the 8th, when they reached 79 4 latitude and 45 38 east longitude, and met with ice again. From this point they took a northerly course, and

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encountered very misty weather. On August 10 they reached 79 40 latitude and about 46 50 east longitude—the farthest point yet reached in this direction. Nothing could be seen but ice in very large and heavy floes, although it was expected that land would have been in sight. They returned in the afternoon with the intention of making for Franz Josef Land, and after getting clear on the 11th were caught in a strong gale and driven south as far as 78 17 latitude and 46 19 east longitude. From this point they steamed right up, and on the 14th, at 8 a. m., they sighted the land. In the afternoon they anchored to a land floe, attached to an island off the mainland—some 1½ miles long. Here they found large numbers of walruses, and that evening the party shot no fewer than 17 of them. They tried hard to capture a young walrus alive, but failed. They caught seven young snow birds with the intention of bringing them home, but only one survived the passage, and it was dispatched to the Zoölogical Gardens along with two live bears on Saturday. Next day they had to shift on account of the drifting of the ice, and in the afternoon anchored to a floe some two miles long at a distance of ten miles from the land. Far "inland" they found an enormous tree with branches and roots apparently complete as it had been torn out of the ground. It is a common thing to find drift wood in these regions, but an entire tree is a rare sight. It is likely that the tree was a Siberian larch, and that it had been washed down by some of the Siberian rivers.

On the 16th they came upon another island, on which they landed, and erected a staff on a cairn, in the center of which they left a record. On these islands a number of curious specimens were found. The last Dutch expedition sighted land westward of this, and called it Barents Hook. This point was also seen by Mr. Smith, and the Eira was steered toward the land. They passed the point close to the land in foggy weather. Early one morning they landed on the island some 20 miles from the easternmost point, and found luxuriant vegetation. While off this island they sounded and found the average depth to be from 15 to 20 fathoms about a mile off the coast. At noon on the 18th they discovered a new harbor, which they had no hesitation in naming Eira Harbor, after their vessel. It is formed by two islands, and affords good anchorage of from five to seven fathoms. It is well sheltered from all sides. It lies in 80 5 25 north latitude, and about 48 50 east longitude. This harbor was made a rendezvous, from which for the next few days, numerous trips were made up the numerous fjords which pierce the main land to the north and northwest. From the point named by the Dutch Barents Hook they traced the land westward some 110 miles, and from the extreme northwest point reached sighted land 40 miles further to northwest. They found that this land was divided from the newly-discovered islands by a sound, which seems to be an extension of Markman's Sound. Lying in this hitherto unexplored tract of sea they discovered seven small islands, each measuring four to five miles long, and four larger islands—these latter being in the vicinity of Eira Harbour—the largest from 18 to 20 miles long, and the smallest from six to seven miles long. They are all covered with glaciers and

snowfields, with bluff, black headlands on the southern exposures, whereon was vegetation. A large quantity of Arctic flowers and other specimens was collected and brought home. On one of these islands close to the harbor were hills 1200 feet above the level of the sea, but large tracts of flats were seen stretching from the foot of the hills. On one of these islands they caught the two bears which, as mentioned above, were sent to the Zoölogical Gardens. The final trip from Eira Harbor was made on August 24, and it was on that day that they reached the most northerly point yet attained in that direction—80 20 north latitude, and about 40 east longitude. From that point they could see land to the northwest, some 40 miles off, and it was supposed that this was but a continuance of the same coast line. This they intended to follow up, but they had again to give up the attempt in consequence of the ice driving along the shore and carrying the ship along with it. Mr. Leigh Smith's opinion is that, whether this land extends in a continuous line northwest or forms the outline of separate islands, it forms a very good basis whence to prosecute researches further northward. When they found further progress impossible they returned, and experienced very bad weather. In one of the deep bays which indent the coast they sighted two Greenland whales, in about the same latitude as the furthest north point attained. They made for Eira Harbor again, but found it full of loose ice. Proceeding eastward, they anchored in a small bay to the west of Barents Hook. From that point they steamed south a little to clear a large quantity of ice that had come out of the fjords, and on the 30th of August they found themselves close to Cape Tegetthoff, which had been discovered by the Austrian expedition in 1873. In that expedition their vessel, the Tegetthoff, was abandoned, and the explorers persevered in their mission by means of sledges; but though they succeeded in establishing the existence of the land, they had to return and make for Nova Zembla in a boat. Mr. Smith made a search for any traces of the abandoned vessel, but found nothing except a "can" on Wilczek Island. They found fast ice between Hall Island and Salm Island, and also between the latter island and Lamont Island, so that there was no means of getting out to the east or northeast, and as the ice was coming down they resolved to try to cut across by Spitzbergen to Wiches Land, or, as otherwise called, King Charles Land. In this endeavor their common enemy, the ice, confronted them and compelled them to alter their course. They sailed close to the edge of the ice as far as 75½ north and 46½ east before they could get west. They reached Hope Island on September 10, and again endeavored to work northward up the east coast of Spitzbergen, but on the 11th the weather became very rough, and for three days the ship was tossed about in strong gales. They encountered numerous small icebergs. Seeing that nothing could be done in this direction—a pack of ice being discernible in the distance—they took a westerly course until they sighted the South Cape, and then steamed up Storfjord and anchored on the 17th near Ginevra Bay. From a hill here they could see the sea to the eastward was clear of block ice, although icebergs could be seen floating about. From

this point Wiches Land could be distinctly seen. Hinlopen Straits also seemed to be free of ice. On the 20th they anchored at the entrance of Walter Thymen's Straits—where they took in ballast—which were also clear of ice. On the 22d they were off Wales Point, and from there they sailed with a fair wind to Hammerfest, in Norway, which they reached on the 25th of September. From that they steamed through the fjords to Tromsoe, and thence to Bodoe. On the way from Tromsoe the Eira went ashore, while under the charge of a pilot, on a reef at the entrance to Tiel Sound, about 11 o'clock at night and just as they were drawing up to the anchorage. The crew made great efforts to release the vessel, but in vain, until on the 4th, when the Norwegian steamer Nordsjerne, which happened to be passing, towed her off with some difficulty. They left Bodoe on the 7th, and, after touching at Lerwick on the 11th, reached Peterhead on the 12th of October. In the course of the voyage some enormous icebergs were seen, measuring from 10 to 12 miles long, having flat "table lands" on the top rising to the height of about 200 feet. They shot 15 bears and 27 walruses, and saw great quantities of saddle-back seals in the water. No reindeer were seen, but snow-hwite foxes were abundant. Careful observations were taken of the temperature and other meteorological tests. Mr. Grant also took numerous photographs of the places visited, and some very interesting specimens of fishes and animals were dredged up and preserved for inspection by scientists in this country. Efforts were made to capture young walruses, but they were unsuccessful, and on one occasion one of the boats was stove in in the attempt. It is gratifying to have to state that no serious case of illness occurred during the voyage. The Eira is to remain at Peterhead until the opening month of next year, when it is understood Mr. Smith will renew his researches.

THE FRANKLIN SEARCH.

We announced yesterday the return in safety of the latest Arctic expedition. Lieutenant Schwatka, of the United States Navy, and his gallant companions, who reached this week the whaling metropolis of Massachusetts, were commissioned, not to make independent discoveries in the region of the North Pole, but to search for relics of the Erebus and Terror. In the process of tracking the footsteps of earlier explorers they have, however, probably undergone as many hardships and had to face as many new difficulties as if the way had never been pioneered before. Expeditions such as this are games of "follow my leader," in which no peril may be circumvented which has once been encountered, and no easy alternative may be adopted. The common type of Arctic journeys presupposes permanent quarters in ships specially constructed and equipped to reproduce as much as may be the comforts of civilized life and a temperate climate in the frigid North. Dr. Kane and other Arctic voyagers have told how possible it is, when the ship is arranged for the night, to look around the warm cabin and almost forget the surrounding waste of savage desolation. Dangers and difficulties

and miseries can never be excluded in this kingdom of darkness and winter. No ship can be so well found as to be secure from them. But in a land expedition, such as Lieutenant Schwatka commanded, while the dangers are as many, the tribulations of daily existence are multiplied a hundredfold. The records of Franklin's land expeditions, sixty-one and fifty-five years ago, and of Back's, eight years later, demonstrate what these are. The American members of the Franklin Search Expedition might repeat those ancient tales of continual conflict with numbing cold and privation with variations of their own. Experiences like theirs of a sledge journey of eleven months it would be difficult to match even in the painful reminiscences of Arctic labors. Always conscious of an enemy on the watch about their path they must at intervals have felt his sword at their very hearts. None who have not braved an Arctic winter can rightly understand the mere meaning of a temperature a hundred degrees below freezing-point. How human frames endured such an ordeal it is hard to imagine. Only the human sense of power to bear what others have borne, and the instinct of an obligation to let no scattered clues of hapless generous endeavor perish unrecorded, could have sustained this little company of dauntless sailors amid the warning evidences of Polar remorselessness.

Confronted with Arctic mysteries men forget the minor distinctions of race and country. They appreciate one another's perplexities; they take up the task at the point at which their forerunner has been compelled to relinquish it; and they award him his full share in the glory of final success. Praise is not grudged to the hand which has passed on the torch, though it could not fire the beacon. There is no stint of tears from the survivors, whatever their nation, for lives sacrificed to the attainment of an end, but left without the prize. Citizens of the United States and Englishmen, Danes and Swedes, North Germans, and Austrians are emulous, not envious of a courageous example which has been set by aliens in blood; they acknowledge the common burden of a duty to bear testimony to victories which those aliens have won, and to the cost they have paid. No page is brighter in the history of human enterprise than that which enumerates the ceaseless efforts of a succession of explorers differing in blood and allegiance to rescue from oblivion the work of Sir John Franklin and his comrades. The veteran Arctic explorers whose letters we publish to-day express a natural regret that the success which Lieutenant Schwatka has won should not have been achieved by their own countrymen. But Englishmen may rejoice that in the long and glorious chronicle of these expeditions their kinsmen from the great American Republic share no unequal space with themselves. The munificence of citizens of the United States went hand in hand with the affection of Lady Franklin and the conscience of the British nation in the resolve to bring succor or to build a tomb. If it was given to M'Clintock to disperse the clouds which enveloped the fate of the vessels and their crews, Kane in the Advance had helped to penetrate the darkness. Lieutenant Schwatka has now resolved the last doubts which could have been felt. He has traced the one untraced ship to its grave beneath

the ocean, and cleared the reputation of a harmless people from an undeserved reproach. He has given to the unburied bones of the crews probably the only safeguard against desecration by wandering wild beasts and heedless Esquimaux which that frozen land allowed. He has brought home for reverent sepulture in a kindlier soil the one body which bore transport. Over the rest he has set up monuments to emphasize the undying memory of their sufferings and their exploit. He has gathered tokens by which friends and relatives may identify their dead, and revisit in imagination the spots in which the ashes lie. Lastly, he has carried home with him material evidence to complete the annals of Arctic exploration. Sir Leopold M'Clintock found that the brave men who perished on their terrible retreat before the legions of cold and disease toward Back's River had before they acknowledged defeat done their work. The Franklin Search Expedition adds the concluding link to the chain. There are skilful eyes and shrewd wits in the dockyard whence the Erebus and Terror were commissioned, which will soon, with the proof which Lieutenant Schwatka supplies, put beyond controversy the question of the right of the especial ship of the two to the fame of having first pierced the awful barrier of the North-West.

It has been a point of honor with sailors and science to collect the uttermost vestiges of the fate and acts of Franklin and his companions. The task is at length finished. Lieutenant Schwatka asserts, on grounds which at present no means exist of examining, that the records of the expedition are lost beyond recovery. Captain Parker Snow, on the other hand, is of opinion that the records may yet be found. However this may be, there is no longer any secret when and where the admiral, his officers, and his men sickened, fell down, and died. The sad details are given in another column this morning and will be read with painful interest. What the unfortunate explorers did is known, and how they did it. Perhaps it may be thought that, now the book of Sir John Franklin's romantic tragedy can be closed, the fruitless, ungrateful, sullen Polar seas may be left to their dead and dull repose. Rather, as it seems from our correspondence of to-day, the sense that the obscurity of a long past incident has been dissipated will nerve seamen eager for honor and careers to push the boundaries of Arctic impossibilities yet further forward. They will forget at what a price the North-West passage was completed. They will make the graveyard of the explorers of 1845 their starting and rallying point, as men build their homes on the walls of cemeteries. What is to be gained by making a habit of achieving the North-West or the North-East passage it is held in some quarters profane to question. We are the less disposed to incur the reproach that we admit the uselessness of resisting an impulse which works as powerfully in Austrian and German and Swedish as in British and American breasts. The praise of courage is not the main inspiring motive. Still less is it the craving for admiration, or the hope of rewards. Men, especially those of Anglo-Saxon and Scandinaivan blood, love to match themselves against the caprices of the elements, and to learn thereby their own capacity to do and to endure. Against such a temperament the arguments of

danger and hardship are of no avail. Only when the Polar seas and lands are mapped, and all their pitfalls numbered and banked up, American sailors will cease from importuning native millionaires to dispatch them northward, and English sailors from fretting at Lords of the Admiralty for economizing seaman's lives. Huge as are the ramparts to be assaulted, and obstinate as are Arctic elements in repairing the slightest breaches ever made, that period will arrive at last. By that time also new perils at least as apparently insurmountable will have been discovered elsewhere to tempt and recompense nautical audacity.—*London Times*, September 25th, 1880.

RETURN OF LIEUTENANT SCHWATKA'S FRANKLIN SEARCH EXPEDITION.

The members of the Franklin search party, under the command of Lieutenant Frederick Schwatka, United States Army, reached New Bedford, Mass. September 22, 1880, having been picked up by Captain Michael Baker, of the bark George and Mary, of New Bedford, at Depot Island, on the 1st of August, they having returned to that point from their sledge journey to King William Land on the 4th of March of the present year. The sledge journey was the longest ever made through the unexplored Arctic region, both as to the time and distance, the party having been absent from their base of operations in Hudson Bay, eleven months and four days. During that time they traveled 2,819 geographical, or 3,251 statute miles. It was the only sledge journey ever made, that covered an entire Arctic winter.

During the summer and fall of 1879 they made a complete search of King William Land and the adjacent mainland, traveling over the route pursued by the crews of the Erebus and Terror upon their retreat toward Back's River, and while so engaged the party buried the bones of all those unfortunates remaining above ground and erected monuments to the memory of the fallen heroes. Their research established the mournful fact that the records of Franklin's expedition are lost beyond recovery.

The Natchilli Esquimaux, who had found a sealed tin box about two feet long and one foot square, filled with books, at a point on the mainland near Backs River, where the last of the survivors of Franklin's party are supposed to have finally perished, were interviewed by Lieutenant Schwatka. These natives broke open the box and threw out the precious records, which were then either scattered to the winds of thirty Arctic winters, or destroyed by the children, who took them to their tents for playthings. This point was not only searched by Lieutenant Schwatka's party, but by nearly the entire Natchilli nation, inspired by a promise of a great reward for the discovery of any remnant of books or papers no matter what was their present condition. This search failed to discover any of the records but resulted in the finding of a skeleton of a sailor about five miles inland. Its existence was previously unknown, even to local tribes. Every native who could

impart any information concerning the lost crews were hunted up and interviewed. Some of them had not seen a white man since Captain Crozier's party was there. The interviews were made through the medium of a competent interpreter, and in this way much valuable information as to the loss of the Franklin records was compiled, It also made known the fact that one of Franklin's ships drifted down the Victoria Straits and was unwittingly scuttled by the Ookjoolik Esquimaux, who found it near an island off Grant Point during the spring of 1849. At that time one man was lying dead in the steerage, and during the same year the natives saw tracks of four white men in the spring snows on the mainland.

The expedition started from the base of operations in Hudson's Bay with but one month's rations of "civilized" food upon their sledges, thus voluntarily submitting to a dependence upon the game of the country through which they passed. The white men of the party began living upon the same fare and conforming to a mode of life strictly in accordance with that of their Esquimaux assistants. The result is shown that it is feasible for white men to adapt themselves to the climate and life of the Esquimaux in prosecuting journeys in Polar regions, and that they are not necessarily restricted to any particular season of the year for that purpose, but can travel at any time and in the same way in which the natives travel. A large quantity of relics has been gathered by the party, not to gratify morbid curiosity, but to illustrate the last chapter of the history of Sir John Franklin's expedition. From each spot where the graves were found a few tokens were selected that may serve to identify those who perished there. A piece of each of the boats found and destroyed by the natives has been brought away, together with interesting though mournful relics in the shape of the prow of one of their boats, the sledge upon which it was transported and part of the drag rope upon which these poor fellows tugged until they fell down and died in their tracks. In addition to these the party secured a board which may serve to identify the ship which completed the northwest passage.

They have also brought the remains of an officer, Lieutenant John Irving, third officer of the Terror, which were identified by a prize medal found in his open grave. The party endured many hardships and were once threatened with starvation, not, as might be supposed, in the course of the sledge journey, but after their return to Hudson's Bay. When the party reached Depot Island there was but one saddle of meat on the sledges, although the return journey was made through a country where game could be procured. This was due to the fact that before the expedition set out, an ample supply of provisions was left in the care of Captain Barry, of the schooner Eothen. He had retained the food on board his vessel, stating that he could take better care of it, and promised to leave it at Depot Island before returning home.

Instead of finding the provisions the party found the natives short of food, as they had been twice before during the same winter, when they were compelled to eat their dogs. Successive storms prevented the hunting of walrus, which is their main dependence at this season. Lieutenant Schwatka's party were consequently

for several days without food, and were reduced to the necessity of eating seal skins, walrus hides and other refuse. The conclusion was forced upon the expedition that Captain Barry, for whatever unexplained cause, had left for home, carrying with him the much needed supplies. No material sickness occurred during the absence of the expedition in the field and no severe frost bites were experienced by any of the party.

STANLEY AND THE CONGO.

While nearly all the States of Europe are represented by their explorers in the Dark Continent, America may well be proud that the most important of all the expeditions, the great Congo mission, is under the command of her own representatives, Henry M. Stanley, or rather Dr. Stanley, as he should be called now, since the Imperial Leopold-Carolinian University at Vienna conferred this honorary title on the greatest of all African explorers for his invaluable services to science and civilization. There is but little news from Stanley's expedition, which is still in the camp at Vivi, on the Congo, 130 miles from its mouth and near the second cataract. It is reported that of his eight European companions one has deserted, while three others have already succumbed to the bad climate and exhausting work. One of these was Alexander S. Deane, the engineer of the small steamer, passing up and down the river with stores and mails for Stanley's station. He died suddenly of fever on May 14, at Dutch House, Banana Point, mouth of Congo. Of Stanley's five boats three were temporarily disabled, one large iron launch had sunk, and the chief steamer Belgigne, was at Banana being repaired. Still Stanley's energy is reported to be unimpaired and ample reinforcements are being sent out to him by his employers, the Belgian International Association. Adolph Gilles, who for six years was agent at Cape Palmas and Grand Bassam for a Dutch trading house, left Antwerp on March 25 last, accompanied by Engineer Geoffroy. They expected to join Stanley in fifty days, and will then superintend the erection of his trading stations on the Congo. The chief party of reinforcements, however, was to leave Liverpool before the end of last month. It consists of five Belgian officers, namely:—The leader, Lieutenant Braconnier, of the cavalry; Lieutenants Haron and Valcke, of the Engineers; Paul Neva, of the road and bridge service, and Lieutenant von Hesse, of the Royal Navy. Their exertions will be chiefly devoted to assisting Stanley's efforts in building a road through the wild coast range of mountains, on which he can transport his boats and supplies overland past the terrible series of the thirty-two Livingstone falls. Lieutenant Haron, however, will not join his companions till later on the Upper Congo, as he has been charged by the King of Belgium, who is president of the International Association, with a secret mission to Africa which may occupy him for ten months, whereupon he will join Stanley. He sailed August 23 for his new destination.

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OTHER CONGO EXPEDITIONS.

Besides Stanley's expedition some other attempts are also being made to explore the great Congo. Mr. McCaul, of the Congressional Inland Mission, has already left England for the west coast in order to make his way into the interior by the northern bank of that river, while the Baptist Missionary Society have sent out Mr. W. Comber. He left England on April 26, 1879, landed at Mussuka, on the Congo, July 2, and reached San Salvador south of that stream. He there established a depot, leaving two of his companions, and went on with a third to Stanley Pool, above the falls, in order to establish there a second station. If he succeeds the mission will attempt to transport a small steamship to that navigable part of the Congo, Robert Arthington, of Leeds, having offered the society $20,000 in aid of this Congo special mission, and particularly for the purchase and perpetual maintenance of a steamer on that river and its affluents. He also stipulates for the establishment of mission stations at the mouths of the great tributaries, Ukuta and Ikelemba.

PROPOSED AUSTRIAN EXPEDITION.

The Vienna Geographical Society has issued an appeal for subscriptions for an Austrian expedition, which Dr. Emil Holub has decided on undertaking. Dr. Holub intends crossing the whole length of Africa, from south to north. He will start from the Cape of Good Hope and penetrate to the Zambesi, thence explore the Maruthemambunda territory, the water-shed district between the Zambesi and the Congo, visit the lake sources of the Congo, and from there through Danfur he will try to reach Egypt. Dr. Holub expects the journey to extend over three years. The expenses, he reckons, will amount to about 50,000 florins, 5,000 of which he can himself supply.

M. SIBERIAKOV'S EXPEDITION TO THE YENISEI.

News has been received from the steamer Oscar Dickson, which, with its proprietor, Siberiakov, on board, set out some time ago to penetrate through the Arctic Sea to the Yenisei. The ship and crew on the 19th of September were in excellent condition at Kabarova. They had met with great difficulties, and had so far been unsuccessful in their object, but were on the following day to make a fresh attempt to find a passage through the Sea of Kara.

A PRIVATE ARCTIC VOYAGER'S EXPLORATIONS.

A telegram dated Hammersfest, September 25, has been received from Mr. Leigh Smith, a private gentleman, on a summer voyage in the Arctic regions in his own steamer. He states that he made Franz Joseph's land August 14, and

explored the west coast to 80° 30′ north latitude and 40° east longitude. He could see land forty miles beyond Markham; says this is the best done yet in this direction. Mr. Smith closes his dispatch with the statement that the exploration of the Pole is not impossible.

ENGINEERING.

THE C., B. & Q. RAILROAD BRIDGE AT PLATTSMOUTH, NEB.

BY A. L. CHILD, M. D.

We approach this bridge from Plattsmouth on the west bank of the Missouri river by a side hill cut and embankment, down the river one-half mile, and then enter a cut through the river bluffs of another half mile ranging from eighty-five feet as a maximum depth, downward.

This cut exhibits several features of interest to the geologist.

It is entirely within the loess formation, the whole body of which, in this cut, is permeated with cracks of from one-fourth inch to four inches in width, running in various directions, which have been filled with a carbonate of lime. This lime hardens to a strong crusty substance on exposure to the atmosphere, and then, as the surface of the cut disintegrates and falls away, these seams of lime are left projecting beyond the surface.

These cracks are probably the result of earthquake action in some past time.

Again, the sides of the cut, under an almost continued change of direction, offer exposures to any and every point of compass; and thus, in its different parts, it is subject to all grades of storm action. And as these storms act with more or less force upon the surface, they leave different but very positive evidences of stratification and consequently of subaqueous deposits.

As we approach the east end of the cut, we pass the debris of an iceberg which stranded here in the earlier ages of the loess deposition.

We now enter upon the west end viaduct, an iron structure of one hundred and twenty feet in length, and some fifty feet in height.

This short viaduct bears us to pier No. 1, on the west bank of the river. This pier is founded on rock thirty feet below low water mark. The excavation for it was made in a coffer dam through sand, blue clay and boulders. The coffer dam was filled with beton and rubble stone; and masonry began at two feet below low water and was raised sixty-two feet above.

The bridge proper, of two spans, each of four hundred feet, commences here; the eight hundred feet reaching the east bank of the river at ordinary stages of water. The bridge of steel and iron is elevated on its three piers sixty-two feet above low water, and with its network of posts, webs, ties, struts, etc., the superstruc

ture rises fifty feet above the piers. It is a Pratt or Whipple truss structure with inclined end posts, the web being arranged with double intersections.

Each span has sixteen panels of twenty-five feet each.

The ties are in two lengths and couple on pins passing through centers of the posts. Attached to these pins a strut extends between each pair of posts, and a system of diagonal wind bracing connects these struts with the top lateral struts.

The middle of each inclined end post is supported by a horizontal lattice work strut, which reaches to the first vertical post.

The floor beams are riveted to the posts immediately above the bottom chords, and act as lateral struts, the lateral ties being coupled on pins passing through jawnuts screwed on ends of the lower chord pins.

The stringers are riveted to the webs of the floor beams.

From pier No. 1 we pass to pier No. 2. This pier is midway over the river, four hundred feet from pier No. one, on the west bank, and the same from No. three, on the east. This pier is based on rock thirty-two and a half feet below low water, by sinking a pneumatic caisson, twenty-one by fifty-one feet, through fifteen feet of sand. This is surmounted by a timber crib-work filled with beton. The masonry was begun at two feet below low water. Like numbers 1 and 3, this pier rises sixty-two feet above low water to the railroad bank.

Another four hundred feet and we reach pier No. 3, on the east bank of the river. This pier is based on rock fifty-two feet below low water, and was built in a pneumatic caisson, the same as No. 2. The masonry was begun six feet below low water. At this point the entire height, from the base of the pier up to the top of the bridge, is one hundred and sixty-four feet.

These piers, one, two and three, have all the same general form, their several tops the same sixty-two feet above low water. Under the coping courses they measure eight by thirty-three feet, the ends being circles of four feet radius. They are built with a batter, or slope, of one-half inch to the foot on sides and ends. At thirty-four feet below the coping courses, the ends are changed to a pointed form, the lines being arcs of circles, struck from points seven feet apart. At the foot of the battered work the piers are thirteen by forty-four feet. They are of first class rock-faced masonry, laid in Portland cement and backed with béton. We now leave the channel of the river and pass on over the three deck spans, of two hundred feet each. At two hundred feet from pier No. 3. we reach pier No. 4., which is based on rock fifty-four feet below low water and built as two and three, in a caisson eighteen by forty feet, through sixty-five feet of sand. The masonry of No. 4 begins at one foot above low water, on the top of fifty-five feet of béton.

Pier No. 5 rests on seventy-eight piles driven inside of a curb eighteen by forty feet to an average depth of thirty feet below low water. These piles are capped by a grillage, and bedded inside the curb in béton; the masonry begins at low water.

Pier No. 6, is founded on concrete twelve by thirty-three, and three feet deep. The masonry of piers four, five and six measures seven by twenty-seven feet under the coping. Each has semi-circular ends, and is about thirty feet in height. The three deck spars rise on these piers to a height of about thirty feet, they are of the "Pratt" truss, with single intersection-webs and inclined end-posts, and have eight panels, each of twenty-five feet. The floor beams rest on the top chords, and the track stringers are riveted to the webs of the floor beams.

Leaving the six hundred feet of deck spans behind, we pass on to an iron viaduct of fourteen hundred and forty feet in length, and ranging from thirty to twenty-five feet in height; consisting of forty-eight spans of thirty feet each. On this viaduct the floor system is uniform with that of the preceding five spans, viz: The track stringers are spaced nine feet between centers, thereon rest nine by nine inch oak ties, spaced fifteen inches from center to center, leaving open spaces of six inches. These ties are generally twelve feet long, and locked on each end by 10x10 inch guard rails. At intervals of five feet a sixteen foot tie projects on each side of the track to support a foot-walk, and at intervals of twenty-five feet ties of eighteen feet length are introduced to support at each end an iron stanchion, through an eye in the top of which a three-fourths inch wire cable traverses the nineteen hundred and sixty feet of iron and steel work, for hand rails. Three by four inch guard angle irons are also bolted to the ties six inches inside of the track rails, to guide trains accidentally leaving the rails.

Having passed the viaduct, we enter upon a temporary wooden trestle work of two thousand feet in length, containing one hundred spans of twenty feet each from twenty to thirty feet in height. This trestle work is for temporary use until it is buried in an embankment which is rapidly progressing. Beyond this trestle work an embankment extends about one and a half miles, ranging from twenty-five five to feet in height.

A summary of the whole work, cut, bridge work and embankment, makes it about three and a half miles long. Iron and steel structure, twenty-nine hundred and sixty feet, and wood two thousand feet. Of the two four hundred feet spans, the top and bottom chords, inclined end posts, main and counter ties, lateral rods, pedestals, rollers, and all chord and lateral pins are of steel. The intermediate posts, end suspenders, lateral struts, portals, stringers and floor beams are of iron. The three deck spans are entirely of iron except the pins, which are steel.

It requires considerable thought to realize the value of the numbers representing the quantity of material required for the entire work. Of steel five hunhundred tons were used. Iron in the viaduct, four hundred and forty tons; deck spans, four hundred and eight tons; bridge proper, three hundred and twenty tons. Total, eleven hundred and sixty-eight tons. Timber, in wood trestle, four hundred and forty thousand feet, (board measure); foundation of bridge, five hundred thousand feet; oak in bridge floor, three hundred and seventy-five thousand. Total, one million, three hundred and fifteen thousand feet, besides a

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large amount of piling, false or temporary supports, etc. Masonry in the six piers, twenty-seven hundred yards; in abutments and trestle work, eleven hundred yards. Total, thirty-eight hundred cubic yards. Béton work, six hundred and fifty cubic yards.

The entire structure was designed by Chief Engineer George S. Morrison and executed under his direction, assisted by First Ass't Engineer, H. W. Parkhurst and Ass't Engineers, C. C. Schneider, B. L. Crosby and W. G. Dilworth. The two four hundred foot bridge spans were manufactured and erected by the Keystone Bridge Company of Pittsburg, Pa.

The entire cost of the whole structure when completed, will be under seven hundred thousand dollars.

On August 30th, 1880, the strength of the bridge was tested by running on each of the two four hundred foot spans alternately, and over the entire structure eight locomotives loaded with coal and water, and concentrating a total weight on each bridge span of about four hundred and fifty tons, under which a deflection of three inches only was produced.

For the foregoing description I am largely indebted to Messrs. Geo. S. Morsison and H. W. Parkhurst, Chief and Ass't Engineers on the bridge, and to articles published by them in the "*Engineering News*," from which I have freely quoted.

RAILROAD BUILDING IN THE ROCKY MOUNTAINS.

The Denver & Rio Grande Company is at present engaged in constructing extensions in seven directions: from Alamosa to Silverton; from San Antonio to Santa Cruz, New Mexico; from Cañon City to Silver Cliff; from Leadville to Kokomo; from South Arkansas to Gunnison; from Poncho to Maysville, and from Malta to Eagle River. These extensions aggregate new track, four hundred and forty-six miles in length. For the reasons that it has to be accomplished in the face of great natural difficulties, through an exceedingly mountainous region and will open and make of easy access a region of vast mineral wealth beyond the Continental divide; for these reasons the extension to the San Juan has aroused a more general and lively interest than the others.

From Alamosa the Rio Grande track proceeds to San Antonio, a station about two miles from the town of Conejos. At this point the New Mexico branch reaches out southward and the San Juan branch turns toward the west. The distance from Alamosa to San Antonio is twenty-nine miles. The latter station is practically the material camp of the Extension company, and the not very thickly populated lots and blocks of the town are covered with fields of steel rails, bolts, bars, etc., waiting for the demands of the contractors at the front. There are at this point or on the line of the road ready to be forwarded, rails sufficient to iron sixty miles of track. At present iron is being received at Denver for reshipment south, at the rate of one mile per day.

It is between this point and the Pinos Chama divide, the terminus, that the

Extension company has accomplished the most difficult work on the branch. The distance from Boydville to what is called Los Pinos cañon, beside which the iron is now being extended toward Chama Peak, is fifteen miles, and the construction of the rail route has required not only a vast outlay of money, but the services of the most skillful engineers, sustained and directed by the greater courage and sagacity on the part of the company, and the employment of thousands of mechanics and laborers. In making the distance between Boydville and the terminus, three low ranges and as many deep valleys have to be crossed. To ascend these mountains, then reach the valley and climb again the steep beyond would have been impracticable, and to surmount the difficulty it has been necessary to follow along the side of the mountain on a uniform rising grade, skirting the valleys, and gradually gaining a higher altitude until the last level before the great divide has been reached. It is along this portion of the road that the most enchanting view of glade and cliff and torrent, of creek, of valley and of mountain top, is presented.

There are two tunnels on this piece of road; one through what has the form of an immense concrete hill and the other through solid rock. An idea of the magnitude of this achievement in railroad building may be gathered from the knowledge that to cover a distance of one-half mile in a straight line, it has been necessary to construct two and one-half miles of track, trestle and embankment, and one mile of this cost $140,000. The curves in some instances are very sharp, but the steel rails were shaped according to minute specifications before they reached the place where they were to be laid, which required the utmost exactness. The outside of each curve is closely and firmly secured by brace chairs, while the inside is as strongly supported and secured as possible. But perhaps the most noteworthy feature of this piece of track, which has been called the "Three-Ply," is the uniformity of the grade. There is no doubt that an operative route from the San Luis to Pinos Chama could have been laid with shorter distance and far less expense, but the easy grade would not have been gained. As it is, the forty miles between San Antonio and Pinos cañon is, if anything, less inclined than the grade between Denver and Pueblo, and the same weight of train can be hauled over these mountains as can be carried along the Denver division.

The present objective point of the San Juan extension is Silverton via Animas City. By far the most difficult portion of the route has been accomplished and beyond the terminus now gained, over forty miles of road-bed is practically ready for iron, which is being stretched at the rate of one mile per day. Just beyond, perhaps five miles from the tunnel, on the Pinos Chama divide, the railroad crosses or meets the Los Pinos toll-road, and the point will be known as the Toll Gate. This is the regular wagon road to the San Juan, and will be the first transportation conjunction between steam and mule power. After Chama is reached work on the extension will not be in the least delayed by snows or winter weather. By the middle of January the track will be in the valley of the San Juan and in the early spring the locomotive will steam into Animas City.

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The San Juan extension, or branch reaching from Alamosa to Silverton, will be 228 miles in length. The line of the road enters New Mexico three times, the second entrance making a run of about thirteen miles. The branch also passes through a portion of the Ute reservation, the entrance upon Indian ground being at a distance of thirty miles probably from Chama summit, or forty miles from the present terminus.

The grade from Animas to Silverton; over a line nearly due north, is natural and easy and will require but very little work as compared with other portions o the route. There is one cañon near Silverton somewhat difficult of passage and a force of men has been at work there for some time making ready thus far in advance for the grading party, which is rapidly and persistently going ahead. It is now confidently believed that Silverton will be reached before the autumn leaves fall next year.

Regarding the other extensions, it will be appropriate, as showing the extent of advancement now being made by the Rio Grande, to refer to them in this connection. The New Mexico line anticipated a length of ninety-one miles due south from San Antonio to Santa Cruz. The latter point is twenty-four miles west of Santa Fe, which places the narrow-gauge within a few hours' stage ride of the New Mexican capital. Of this distance, sixty-five miles have already been ironed, and the entire length of this branch will be in operation by November 10th. Three hundred track-layers are now at work on this extension, and all the grading has practically been done. Track is going down at the rate of half a mile a day, and if a deep and difficult rock cut had been completed the Rio Grande would have been reached before this.

The Gunnison branch starts out from Cleora, or South Arkansas, proceeding to Poncha, a distance of five miles. Here the road parts, one branch leading up to Maysville, eight miles, and the other or main line going via Marshall Pass to Gunnison City, sixty-five miles. The grading on the Maysville branch is very light, as cheap as the Platte valley. The Gunnison line is more difficult, but nothing as compared with other achievements of the company. It is expected that track laying will begin on this line within ten days and it will be pushed with all speed.

The branch from Leadville to Kokomo is nearly completed, and within twenty days trains will be in operation. This branch is twenty miles long and will be extended to Breckinridge right away.

Two hundred men are at work on the branch from Malta to Eagle river, which will be thirty-one miles long, the objective station being Red Cliff. It is confidently believed that the line will be in operation early in the Spring.

On the Silver Cliff extension from Cañon City, three hundred men are employed, and every exertion is being made to complete the road as early as possible. The line has been graded for nearly twenty miles, and as there is little fear that the snow will halt the work, the entire distance of thirty-one miles will doubtless be accomplished some time during the month of January.—*La Plata Miner.*

VELOCITY OF SHOT, WITH SUGGESTIONS TO SPORTSMEN.

As a result of laborious and scientific experiments, Professor Mayer, in his paper on this subject before the American Science Association, presented the following tables:

I. 10 Colt gun, 5 drs. Curtis & Harvey powder, 1¼ oz. of shot.

Size of shot.	Vel. at 30 yds.	Vel. 40 yds.	Vel. 50 yds.
No. 1 buck	1,147	1,132	—
FF	1,146	1,126	—
BB	1,153	1,067	—
No. 3	1,066	1,015	928
6	1,012	963	859
8	995	880	775
10	908	803	716

II. 10 Colt gun, 4 drs. Curtis & Harvey powder, 1¼ oz. of shot.

No. 1 buck	1,067	1,018	—
FF	1,017	1,009	967
BB	1,000	967	897
No. 3	989	911	872
6	966	883	806
8	920	874	776
10	848	756	669

III. 12 Colt gun, 3¼ drs. Curtis & Harvey powder, 1⅛ oz. of shot.

No. 1 buck	—	703	—
FF	—	—	706
BB	862	795	667
No. 3	844	754	696
6	825	739	600
8	816	749	607
10	796	680	610

IV. 12 Colt gun, 4 drs. Curtis & Harvey powder, 1¼ oz. of shot.

8	847	722	671
10	748	657	596

A glance at these tables at once shows the rapid increase in the velocity of gunshot from No. 10 up to No. 3. With the heavier pellets the increase in velocity is less marked. Thus, the table headed "12 Colt gun, 4 drs. Curtis & Harvey, 1¼ oz. shot," shows that No. 8 shot has 71 feet per second velocity over No. 10 shot, and No. 6 has 47 feet over No. 8, while No. 3 has only 23 over No. 6, and BB shot gains only 11 feet over No. 3. The relations between velocity and weight of pellet shown in this table may be taken as a type of all the experiments, and I have projected them into the accompanying curve, the units of whose axis of abscissæ are units of weight, and the units on the axis of ordi-

nates equal four feet of flight of pellet. The next fact, and an important one to sportsmen, which is shown by these experiments is this: If the same charges of powder and shot (4 drs. powder and 1¼ oz. shot) be fired from a 10 gauge and from a 12 gauge gun we get a velocity of 100 feet per second in favor of the 10 gauge. This is conclusively shown in the comparison of the figures in the tables headed "10 Colt gun, 4 drs. C. & H., and 12 Colt gun, 4 drs. C. & H., 1¼ oz. shot." With No. 10 shot the mean velocity over the first 30 yards given by the 10 gauge gun is 848 feet; with the same shot and charge in the 12 gauge the velocity is 748 feet, a difference of 100 feet in favor of gauge No. 10. With No. 8 shot the difference is 72 feet. The average difference in favor of the 10 gauge in the flight of No. 8 and 10 shot over 40 yards and 50 yards amounts to 110 feet.

I trust that these results will show to sportsmen and the makers of guns that the recent movement in favor of small bore guns is one in the wrong direction. If any gunmaker will make a 10 or even an 8 gauge gun, weighing about 7½ pounds, the sportsman will have the best fowling piece for upland shooting. The reason why a 10 guage shows such superiority over a 12 gauge is that the same charge of powder and shot occupies less *length* in a 10 than in a 12 gauge, hence there are fewer pellets of shot in contact with the barrel of the 10 gauge to oppose by their friction the projectile force of the powder; and, secondly, the powder in a 10 gauge gun is exploded nearer to the center of its volume, and thus the powder first exploded does not have so much chance of blasting before the unburnt powder contained in the charge is removed from the point of ignition. I also venture to predict that, with the same weight of barrels, the 10 gauge will not heat as much as the 12, because the motion of the shot lost by the greater resistance it opposes in a 12 gauge cartridge must appear in the form of heat. The third fact which these experiments show is that the proper charge of shot in a 12 gauge gun for upland shooting is 1⅛ oz., and not 1¼ oz., as has of late years been the practice to use; for the tables show that with 1⅛ oz. of shot and 3⅛ drs. of powder an average velocity is obtained, which requires 4 drs. of powder to give to 1¼ oz. of shot a velocity equal to that given by 3¼ drs. to 1⅛ oz. Now 4 drs. of powder, if not fired from a gun weighing at least 9 lbs., and from a good, strong, muscular shoulder, is disagreeable. The effect on the body, and especially on the brain, is neither conducive to pleasant or good shooting. The number of pellets in a charge of 1¼ oz. of No. 8 shot is 499. In a charge of 1⅛ oz. of the same shot there are 449, therefore only fifty pellets more in a charge of 1¼ oz. than in a charge of 1⅛ oz., and surely the want of the 50 will not cause a good shot to miss his bird with 449 pellets, nor will the addition of the 50 give a bad shot more chance of bringing his bird to bag with his 449 pellets.

I wish now to show to the Association, and especially to those members of it who are sportsmen, other applications of these experiments to the art of shooting on the wing. There are two styles of shooting on the wing. One is called "snap shooting," when the shooter, on selecting the bird which he wishes to bag, quietly brings the gun to his shoulder, and at the instant it is in place fires. If

the bird is a cross-shot, he determines at the moment of fire the distance to which he should direct his gun ahead of its flight, this distance depending on the velocity of the bird's flight and on his distance from it. This manner of shooting practiced the more generally by upland gunners in shooting quail, grouse, and woodcock. The other style of shooting may be designated as "the swing shot," in which the gunner swings his gun ahead of the cross flight of the bird till he attains the proper distance ahead of it, and then fires, but keeps his gun moving with a regular angular velocity till even after its discharge. This method of shooting is, in my opinion, and from my experience, the proper method; and is certainly the only one which has been found successful with shooting of bay fowl —as ducks, brant and wild geese. Yet there are sportsmen who will contend that they merely follow the bird with the gun, and discharge it while it is pointing at the bird. I put this opinion to the test this summer in the following manner: Four willets came over the decoys, flying in line with a good speed. With my gun I followed the first bird, coolly and accurately, and kept the gun moving regularly after its discharge. Instead of killing the first bird, the third from the leader dropped dead. To give a rule applicable to all gunners as to the distance at which a gun should be pointed ahead of a bird, is not possible. Some sportsmen follow a bird, and then, after reaching before it the proper distance, suddenly stop the angular motion of the gun and then fire. Others, after following the bird a short distance, give a quick lateral motion to the gun and then fire. Others, again, bring the gun with a lateral motion ahead of the bird, and keep the gun moving till their experience decides the proper distance ahead of its flight, and fire while the gun is keeping its previous regular velocity. For the simple illustration of the bearing of these experiments on the art of shooting on the wing, I will suppose that at the moment of fire the gun is stationary; in other words, that we are firing "snap shots." If the bird has a velocity across the line of flight of 30 miles an hour, and we are using charges in a 12 gauge gun of 3¼ drs. of Curtis & Harvey powder and 1⅛ oz. shot, we will have to shoot about 5 feet ahead of the bird if it is flying at a distance of 30 yards at 7 feet ahead; if at a distance of 40 yards, and 11 feet ahead of the bird if at a distance of 50 yards. These distances ahead for cross shots at birds flying at the rate of 30 miles an hour may appear out of all reason with the experience of many sportsmen; yet if you will place a stick 5 feet long at 40 yards and ask the same gunners if they would hold ahead of a bird by that distance if it were going with a velocity of thirty miles, I venture to say, from my experiments with them, that they will say, "Of course, that is only about 18 inches;" so difficult is it to determine a length at a distance while sighting along the barrel of a gun. I will conclude with the remark that this paper will not make a good shot on the wing, no more than a description of how to perform on the violin will make an accomplished violinist. It has been said, perhaps rather strongly, that a "pedagogue can teach to read and write, but a crack shot is the gift of the gods."—*Scientific American.*

APPLIED SCIENCE.

THE NATURAL SCIENCES: THEIR NEWNESS AND VALUE.

PROF. T. BERRY SMITH, LOUISIANA COLLEGE, LOUISIANA, MO.

Science is classified knowledge. We may know never so many isolated facts, and yet our knowledge be unscientific. In fact, we all do know a great deal about ourselves and our surroundings, and yet, because we do not understand the relations existing between the facts with which we are familiar, we cannot say we are versed in science. Now, natural science is the classified knowledge of the material world—it deals with matter, the phenomena exhibited by and in matter, and forces, or the causes of phenomena. Natural science may be discussed from several standpoints, but in this paper, the subject of the newness and the value of the natural sciences will be considered.

Knowledge is a thing of growth. The new-born babe is utterly ignorant and acts only as impelled by instinct. But within this same infant brain are infinite capacities for acquiring knowledge. Newton, Galileo, Agassiz, all the proudest masters of the human race, were once helpless babes. And yet, in the course of four score years they comprehended much of the mighty forces of the universe, and understood a multitude of the facts and phenomena of matter.

Now, just as any individual of the human race grows from infancy and ignorance to old age and some degree of knowledge, so the human race itself must have had its period of infancy and ignorance, and has been, and is yet, growing toward seniority and a wider acquaintance with the universe. If this be true, then if we can find the order in which an individual acquires knowledge, we will also know the order of the growth of knowledge among the human race.

During its earliest years the child learns to eat, to laugh, to cry, to walk, to talk, to sing, to climb, and to do numerous other acts by imitating the example of the elders about it. Ideas of distance, size, surface and other qualities of matter are not acquired until several years are past. Proper conceptions as to them must be gotten by personal experience. Then, as years of maturity approach, ideas of relation and of laws begin to come to the mind through inductive processes. Hence knowledge may be classified as (1) Imitative, (2) Experimental, (3) Inductive.

Let us apply this order of advancement to the human race. After the birth of the human race, there were long ages which we may term its infancy, during which the struggle for existence dominated and curbed all mental advancement. Means for defense against savage men and still more savage beasts, and methods of procuring sustenance and bodily comfort occupied the entire thoughts of men and left them time for nothing else.

Gradually, however, this period passed away, and the era of imitation began to develop itself. What constitutes the knowledge of man which may be called imitative? For answer let us look to history. Out of the dim mists of the past we gather the grandest forms of poetry, oratory, sculpture, architecture, etc., that the world has ever seen or can see. And why? Because they are all imitative in their origin, and employed the minds of men during the childhood days of the human race. For instance, let us consider sculpture. From the hands of the Creator—the Master of the universe—came models as perfect as could be. Forms of men, of animals, of trees, of all natural objects were perfect. There was only required in man genius with suitable materials placed at its disposal to produce an imitation as nearly as possible like the original model, and afterward it would be impossible to go any further in this line. As to painting, nature showed the landscapes, the light and shadow to colors, and the artist must only copy the objects correctly and color them properly, and human hand could do no more.

In architecture, the growth was somewhat slower, and yet the noblest forms and most admirable styles were early reached. Language was another imitative acquirement. The earliest words, I doubt not, were articulated in imitation of sounds produced by various animals or various phenomena. Soon all the more noticeable objects and acts in any locality had received names, and these names became fixed for that locality. They descended from father to son and were carried in their migrations from one country to another. Thus spoken language began. Written language was a thing of later birth, and grew out of signs and symbols made to represent things. The earliest written language of human origin is hieroglyphic. The multiplication of symbols, as knowledge increased, led to the adoption of a few artificial characters as symbols of sounds, which, being combined, would represent all objects and phenomena whatsoever. Then as soon as possible came the poets and historians, who gathered up the traditions of their peoples and wrote them down, They appropriated all the imagery and tropes and figures of earliest speech, and left behind them works which lose no luster with the flight of years. After them, everything must be taken second-hand—the best had been done. Out of the written language arose grammar, rhetoric, etc., as the laws of both spoken and written language. The science of numbers arose partly from imitation and partly from experiment. The rise and set of the sun would naturally become the unit of measure of time. The course of the four seasons, and their constant recurrence in the same order would fix the length of the year. In measuring magnitudes, what more easy of access than the hand, or arm, or foot, or stride, or height? Men having become accustomed to the use of these, the need of uniformity would lead them to adopt a measure taken from the arm or foot of a king or leading man. A unit once adopted would be handed down, as our yard stick, which dates from the reign and arm of Henry I. of England (1120 A. D.) The origination of a system of notation and numeration soon followed, to be transmitted from generation to generation.

Now, the sciences we have thus far glanced at were to a greater or less de-

gree imitative; and the fundamentals of them were such that, once established, they became enduring. As the purposes they served were equally applicable in all places and times, by migration they spread over the earth and by transmission passed down from father to son. And to-day we make use of artificial standards, of artificial letters, of words long coined, of much imitative knowledge, nor ever spend more time upon them than is necessary to fix their names and meaning in our minds.

But now let us turn to the second kind of knowledge—the experimental—and trace its origin and growth among the human race.

Just as the experimental knowledge of the child arises mostly from contact with Nature, so the experimental knowledge of the race must be, for the most part, a knowledge arising from contact with Nature. Now, though the fundamental ideas in the natural world are few and everywhere the same, yet in the execution of these few ideas there is such endless variety that the natural conclusion in regard to them would be, especially to a casual observer, "There is no law in Nature—all is confusion and chance." The people of one region, migrating to another more or less remote, would find an almost entirely different phase in Nature and the phenomena it exhibited—especially of plant and animal life, which lends so much to the formation of variety in nature as presented to us in various places. Varieties of climate, differences of heat and cold, of rain and wind and length of day and night—all these and many other things would lend very little encouragement to the student of Nature. Had an observer lived long enough in one place to know well by experience the general features of that locality, yet removal to another might present such contradictions as to shake his confidence in his former observations. All such experience rendered the knowledge of nature a thing of slow growth. Before it could be found that under all the variety of external nature ran an undercurrent of unvarying sameness and that all phenomena occurred in obedience to inexorable law, it was necessary that ages should pass away, that the human race should inhabit the whole world, that easy means of communication should be invented, that civilization should spread abroad its benign influences, that peace should link in friendly communion the nations of earth, that life should grow less imburdened with the struggle for existence and have more of leisure, and lastly, that multitudes of observers in all quarters of the globe must carefully and faithfully record their observations from year to year through many generations. But none of these conditions existed during the early ages of the human family. And therefore the sciences of nature were of very slow growth. Because very much of the heavens above us is always visible at night, and because the stars are always beautiful and attract attention, it was very natural that the science of astronomy should take some form at a very early date. Except astronomy, however, none of the natural sciences assumed any valuable form until within the most recent times. The last three centuries have witnessed the birth and growth of nearly all that we call natural sciences. Even our own lives are contemporary with constant advances, conquests and developments in

the domain of nature; while the sciences of language, figures and so forth have grown hoary with years of maturity.

The order of development of the various branches of natural science would be from those of tangible matter, as physiology, zoölogy, botany, mineralogy, to those of intangible matter and the phenomena and forces of matter—for which reason chemistry is hardly a century old and meteorology is yet in its childhood. The course of progress has been from molar to molecular—from worlds to atoms—from simple to complex: evolution is the term to apply to the growth of knowledge as well as to the growth of material order. Hence the natural sciences are new—and are new of necessity.

And just here let me throw in a word on the subject of the inspiration of the Scriptures. Modern research as to the history of the earth has developed facts which most harmoniously agree with the record of creation as given in the first chapter of Genesis. If it be acknowledged that all the observations of many men for many years were necessary to unfold the order of development of the earth, and that the facts in the case have only lately come to be known, viewed from a natural standpoint, then whence came the wonderful information of the writer of the book of Genesis? Certainly it was not of human origin. Therefore we are driven to the conclusion that it was of divine origin. I think this a very powerful argument in favor of the inspiration of the Scriptures.

Having discoursed at some length on the newness of the Natural Sciences, let us come now to the subject of their value. We now enter upon ground over which many mighty and stubborn conflicts have been waged, the combatants being the adherents of Imitative Knowledge against the followers of Nature. Because the Imitative Sciences are almost as old as the race of man, of course they have almost up to the present time been foremost in the minds of men. It is a well-known fact that any party in power has always struggled to keep down an opponent, though the success of either meant the same good for all. Following this law, the advocates of Imitative Knowledge have beheld with jealous eye the growing favor of the Natural Sciences; and the war yet goes on, though with diminished fierceness.

To-day I plead the cause of Nature, and claim for its sciences as important places in our schools as are now occupied by the sciences of language, figures, etc. Please note well that I do not ask for them more prominence, but equality only.

Let us compare briefly the methods of study and results obtained in each course, and then we can better compare the value of them in their influence upon the human mind.

Here is an old fashioned school. The principal duties are spelling, reading, arithmetic, grammar, etc. Day after day and year after year the children gather in with their printed books and con over the pages of uninteresting matter. Long wordy rules are memorized and recited, but the recitation is that of the parrot; the philosophy of them is not understood at all. How well we all remem-

ber the rules of common fractions, of square and cube root, of syntax! And to-day the majority of children are ground through the educational machine in the same old way; and when they are asked for reasons for the answers given when questions are propounded, they are sure to reply "the books say so." The old system has very little in it to make independent thinkers. It is no wonder that for ages in the olden times only one system of medicine was in vogue—public opinion compelled all to follow in the footsteps of Hippocrates and Galen. It is no wonder that the masses of the people at the present day are startled into open-mouthed wonder by the veriest knaves, and are led off after will-o'-the-wisps because they appear to be something of worth. The majority of people are guided by external appearances—just as they were in going through their text-books—nor ever seek for undercurrents or causes.

But now let us look in upon a school where Nature is unfolded to the children—or rather by the children. No text-books are used in the lower grades—only the wide-spread volume of Nature is kept before them. They are directed to bring in leaves, or flowers, or insects, or rocks, or anything else of manifold Nature. Attention is directed to differences and resemblances.

A fundamental idea or two is given to them by the teacher, and then they fully verify these ideas by examining the objects in hand. The fact becomes each child's personal property, not because book or teacher says so, but because they themselves, by personal experience, have proven it to be true. It has become verily a part of the child—a solid growth. Having grasped in this way a few fundamental ideas, the process of sub-dividing according to some prominent characteristic, apparent in many of the objects at hand, easily follows; and soon analytic and synthetic processes, based on personal observation and thoroughly to be relied on, because matters of personal experience, produce a strength of mind and independence of thought not to be acquired in any other way. As far as anything pertaining to the material world goes, they become strangers to credulity, and only that is accepted as truth which has been tried and stood the test. I grant some may drift into infidelity because they attempt to prove all things both finite and infinite, and fail; but I would rather have some infidelity among much strong wisdom, than all-abounding credulity.

Thus far I have considered the value of the Natural Sciences as subjects of mental discipline in our schools. But the study of Nature has other points of value. It affects our personal welfare. Nature is all about us—ourselves the highest and noblest factors in it. To make our personal welfare the best possible, we should know ourselves; but a full knowledge of ourselves demands acquaintance with all that can affect us in any way: we are affected by universal Nature. We live continually in the presence of Nature and behold constantly its phenomena. If we know not the relations existing between ourselves and the phenomena we behold, then we are apt to be like the people of old—superstitious and forever in dread. But beyond the mental effects we may experience, there are others of much more importance—even physiological ones.

XUM

This human body is strangely and wonderfully constructed. A grain of one substance may nourish, of another cause instant death; one plant may furnish delicious food, another deadly poison. We should all certainly know the value of one organ of the body above another. We should all know how murderously ruinous it is to constrict the organs upon which the very life depends. We should all know enough of human physiology to understand that the cramping of the Chinese foot is less suicidal and barbarous than the constriction of the American chest. We should all understand Nature well enough to know that violation of her laws will surely be punished—that she permits no sinning on her estates. Were all properly versed in Nature and her laws, "perpetual motion" and kindred topics would drop into utter oblivion. But we must pass on. From a social standpoint, the study of Natural Science is valuable. Nature presents herself in multitudinous aspects, and no two eyes ever see just the same aspect. Hence the experience of each mortal observer is different, in a greater or less degree, from that of all others of his human kind. Hence if all should be tutored in the great fundamentals of Nature, then when the social company was assembled, subject for conversation need never fail. There would need be no silent sitters because the topic in hand was one never studied—was one of which they had no experience. Of a natural tendency to use Nature as a subject of conversation, note how people universally say "good morning," "rainy day," "disagreeable night," etc., when greeting each other.

Again the study of Natural Science has its value to the teacher. All through the country, in every district school, what a glorious chance for the teacher to lead the children away from the dry tasks of text-books and regale them at the feast of Nature forever and unstintedly spread out around the door! In Summer and Autumn, in Winter and Spring, an endless profusion of objects and changes invite to their study—a study that is a pleasure and not a task.

Lastly, and rising in value far above all things we have mentioned, the study of Nature expands our souls as well as our intellects. Studying Nature, how easy it becomes to look for and adore Nature's God—the Creator of all! What study of letters, or grammar, or figures, or problems, ever appeals to anything but the intellect? But the study of Nature presents such evidences of beautiful design and such unapproachable wisdom that the intellect bows down before it and sends its high priest—the Spirit—into the Holy of Holies to worship at the shrine of the Omnipotent One. After that we live nobler lives and pay deeper devotions to "Our Father who art in Heaven."

I sum up as follows:—

Science is classified knowledge, and may be divided into

1. Imitative Science;
2. Experimental Science;
3. Inductive Science.

Natural Science is *new*

1. Because classified knowledge of Nature is of recent origin;

2. Because new phases are ever being unfolded to us;
3. Because Nature, as a whole, never grows old.

Natural Science has *value*.

1. It develops the analytic and synthetic powers of the mind, and makes independent thinkers;
2. It affects us personally, keeping us from superstition and helping us to know and preserve our frame;
3. It affects us socially;
4. It aids the teacher in teaching;
5. It reaches the soul as well as the intellect, and leads us to God.

HISTORY OF THE STEAM ENGINE.

FROM PRESIDENT R. H. THURSTON'S INAUGURAL ADDRESS BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, NOV. 4, 1880.

As an illustration of the method in which advancement occurs, and as an example of the kind of work which remains for us to do, let us glance, very briefly, at the history of that greatest of modern triumphs of mechanism, the steam engine.

Away back, twenty centuries and more, in the dim past, among the first faint gleams of historic civilization, we see the germ of the invention which has done so much to annihilate space and give man illimitable power over all the forces and treasures of nature—a toy in the museum at Alexandria. A toy it remained many centuries, until, in the grand awakening of three centuries ago, its latent power was discovered, and Papin, and Worcester, and Leibnitz, and Huyghens each contributed a thought in the progress which they thus inaugurated. A hundred and fifty years ago the "steam giant" was at work under the direction of the intelligent blacksmith and his comrade, the "tinker," doing much for the mining industry, but nothing elsewhere, and, hampered by ignorance, and ill-cared for by his masters, wasting a vast deal of now utilized power.

Then came forward a genius of the brightest intellect, a mechanic, such as the world rarely produces—James Watt—and, adopting the truly philosophic method, the great master soon taught the mighty servant to do a thousand times more for the world, and to labor with wonderfully greater ease and economy. Watt first collected his facts. He dissected the model of the Newcomen and Calley engine, which had been placed in his hands for repair, ascertained the method of its operation, learned what were the advantages of that form of engine, discovered the cause and extent of its losses of power and efficiency, and, once these were known, his grand intellect promptly devised remedies and improvements, and the steam engine of to-day is simply the steam engine of James Watt, in all its leading features and in all the principal details of design. Its steam-jacketed cylinder is Watt's; its parallel motion and its guides; its crank motion,

although an invention usually ascribed to another, were invented by Watt, and the condensing apparatus, the expansion gear, the governor, and even that wonderful little instrument, the "indicator"—the engineer's stethoscope—all came down to us from the same source.

Watt learned the leading facts and made the greatest modifications of plan, while it was reserved for our contemporaries to contribute the refinements of its design and of its manufacture, and to study the more deeply hidden principles of its philosophy, and to determine more definite rules for its construction and management.

Those of you who have been familiar with the design and construction of steam engines during the past twenty or thirty years,† and those of you who have been for a generation past accustomed to handle this miracle of art will remember, as I remember well, how we learned at a very early period in our experience certain cardinal points of practice which were very strongly impressed upon us. We soon learned by experience that efficiency was gained only as we learned to handle higher steam with properly adjusted expansion, to work our engines up to higher piston speeds, to cushion heavily when we had large clearance, to reduce that clearance to a minimum, to adjust the size of our engine to its work, and to determine the point of cut-off, under proper conditions otherwise, by the governor.‡ We learned that the now well-known "American Automatic Cut-off Engine," with its high steam and moderately large expansion, as exemplified by the "Corliss Engine," which is now built all over the world, was the representative of the best general practice.

But we were not satisfied. Twenty years ago we began to understand that we had yet to perfect the phylosophy of the steam engine, and that it was still apparently far from perfect efficiency. We then discovered that while our best engines were consuming from twenty-five to thirty pounds of dry steam per horse power per hour, the mechanical equivalent of the heat supplied in the steam in boiler was sufficient to give about a horse power for each two pounds of high-pressure steam per hour, and hence that we were utilizing but one tenth or one-fifteenth of the heat we were paying for when we settled our coal bills.

Next, we found that, owing to the fact that we can not practically expand down to a pressure lower than that due approximately to the temperature of surrounding bodies, we must therefore discharge heat unutilized, that the larger part of this waste is unavoidable and that an engine, perfect mechanically, and working within the usually practicable maximum limits, must waste three-fourths, and can return useful effect from but one-fourth, of the heat supplied, thus placing the practical limit under known conditions at about eight or ten pounds of steam per hour and per horse power.

And here we stand to-day with the steam engine, mechanically almost perfect, yet with a theoretical economy of about eight or ten pounds of steam per horse

† Reports on Machinery and Manufacturers at Vienna, 1873, by R. H. Thurston, etc., etc., Wash., 1875.
‡ History of the Growth of the Steam Engine; International Series; N. Y., 1878, p. 473.

power per hour, while consuming actually, in the best examples, about fifteen, *i. e.*, with an efficiency of sixty or seventy per cent.

In hot-air engines we are not making much more progress, and our field of promise seems to be still in the improvement of the steam engine.

We are slowly learning other facts. We know that the great obstacle in the way of attaining nearly theoretical efficiency is the transfer of heat from the steam to the exhaust side by initial condensation and re-evaporation; we are discovering that high speed and steam jacketing tend to lose their efficiency at extremely high pressure with wide ranges of expansion, that it seems possible to reach a point in steam-jacketed cylinders at which lower speed may tend to secure efficient working of the steam; that with well-jacketed cylinders we may get good performance, as we to-day judge it, with slow pistons; that we have better work claimed to-day for single than for "compound" engines by ten or fifteen per cent., § the minimum yet reached under fair conditions for economy being stated to be by experiment as 1.54 is to 1.75, while, assuming the very best conditiovs for each, it seems certain that both types should give about equally good results.

Here is where we stand to-day, and it is from this point that we are to work forward. We need to collect more facts by means of carefully-devised experiments like those of Hirn and Hallauer abroad, and of Emery and the Navy Department at home; we need careful and systematic study of the results and finally the determination of the laws of steam engine efficiency as affected by steam pressure and temperature, rates of expansion and compression, character of steam jackets, rate of piston speed, and every other circumstance influencing economy.

ASTRONOMY.

PLANETARY AND STELLAR PHENOMENA FOR DECEMBER, 1880.

BY W. W. ALEXANDER.

Mercury rises on the 1st at 5 h. 44 m. a. m. and on the 31st 6 h. 21 m. a. m. and is at its western elongation on the 21st, at which time it can be best observed, being then in the constellation Scorpius about 7° north of Antares.

Venus sets on the 31st at 6 h. 58 m. p. m. and on the 31st at 8 h. 03 m. p. m., and is fast increasing in size and brilliancy.

Mars rises on the 1st at 6 h. 10 m. a. m. and on the 31st at 5 h. 56 m. a.

§ Abstracts of Papers, No. 1602; Proc. Brit. Inst. C. E., Vols. LIII, LIV. It would seem that where slow piston-speed is demanded, as usually with pumping engines or where two cylinders are needed as with marine engines, the "Compound" engine is unmistakably best; while where high-speed engines are permitted, as in mills, the single-cylinder may still hold its own in this competition.

m. It is in conjunction with Mercury on the morning of the 23d, distance 1° 5′ south.

Jupiter sets on the 1st at 2 h. 03 m. a. m. and on the 31st 00 h. 11 m. a. m. Owing to its increased distance from the earth I omit the phenomena of its moons.

Saturn sets on the 1st at 3 h. 7 m. a. m. and on the 31st at 1 h. 08 m. a. m.

Uranus rises on the 1st 11 h. 51 m. p. m. and on the 31st at 9 h. 5 m. p. m.

Neptune sets on the 1st at 4 h. 47 m. a. m. and on the 31st at 2 h. 46 m. a. m.

The *Moon* will first appear low down in the southwest on the 2d and will be in conjunction with Venus on the 4th; on the 5th and 6th it will be in the constellation Capricornus; on the 7th and 8th it will pass through Aquarius; on the 9th and 10th it will be in Pisces, the present location of Saturn and Jupiter, from thence it will pass through Aries, Taurus, Gemini, Cancer, Leo, Virgo, Libra, and on the 28th and 29th it will be in Scorpius, the present location of Mercury.

The following is the position of the constellation, on the 15th at 6 h. 30 m p. m. and will nearly be correct for the entire month.

Beginning in the north at the horizon we have Ursa Major, drawing a line from thence up toward the zenith it will cross Draco, Ursa Minor and the eastern edge of Cepheus and then comes Cassiopæa situated in the Milky Way, following which westward we shall cross Cepheus, Cygnus, Lyra, and Aquila, while toward the east Perseus and Auriga. In the south Pegasus the Flying Horse is the most prominent constellation. It is marked by four stars of the second magnitude which form a large square, each side of which is about fourteen degrees.

Andromeda, her hands in chains, lies northeast from the northeast corner of Pegasus in the direction of Perseus, and contains three bright stars nearly in a row.

Cetus, the whale, occupies the south, extending from the meridian to a point three hours east of it.

A very slight declivity suffices to give the running motion to water. Three inches per mile in a smooth, straight channel gives a velocity of about three miles an hour. The Ganges, which gathers the waters of the Himalaya Mountains, the loftiest in the world, is, at 100 miles from its mouth, only 300 feet above the level of the sea, and to fall 300 feet, in its long course, the water requires more than a month. The great river Magdalena, in South America, running for 1,000 miles between two ridges of the Andes, falls only 500 feet in all that distance. Above the distance of 1,000 miles, it is seen descending in rapids and cataracts from the mountains. The gigantic Rio de la Plata has so gentle a descent to the ocean that, in Paraguay, 1,500 miles from its mouth, large ships are seen which have sailed against the current all the way by the force of the wind alone—that is to say, which, on the beautiful inclined plane of the stream, have been gradually lifted by the soft wind, and even against the current, to an elevation greater than our loftiest spires.

XUM

EXPLORATION.

LOG OF THE STEAMSHIP "GULNARE" FROM ST. JOHNS, N. F., TO DISCO AND RETURN.

Friday, July 30, 1880.—Fresh breeze from the south. Started the fires, and at 3:30 p. m. took up our anchor and put out to sea. Two of the sailors were missing and two deserted. Gales and thick fog. Distance by log seventy-five and three-quarter miles.

Saturday, July 31st, 1880.—Strong breeze from the south during the first part of the day. Steering east. Thick fog and rain. Fog lifted at 1 p. m.. Saw an iceberg to the east of us. Running under F. G. sail and half steam. Distance by log 253 miles. Course East by N.

Sunday, Aug. 1st.—During the first part of the day light winds from SE. Steering E. SE. Later, wind from the west with rain. Saw a steamer steering SE., also a small iceberg. Lat. 53° 47′ N., Long. 40° 29′ W. Distance by log 204 miles.

Monday, Aug. 2d.—Light wind from the south. Steering NE. by E. All sail set. Distance by log 207 miles.

Tuesday, Aug. 3d.—During the first part of the day strong wind from S. SW. Steering NE. by E. At 4 p. m. furled F. top-sail and G. gallant sail and jibs. Thick fog and rain. At 3 p. m. slowed up and headed the ship to the SE. under close reefed sail. Gale increased and we shipped much water. Distance by log 90 miles.

Wednesday, Aug. 4th.—Heavy gales from S. SW. and the sea running high. At 2:30 p. m. the larboard boat washed away. Threw a part of the deck-load overboard to save the ship. Made a break in the bulwark to let the water off deck; this eased the ship very much. The gale still continued with rain and fog. At 9 p. m. began to moderate. A high sea running, kept off to the NW. running at half speed. At six in the morning saw land, Cape Farewell, about twelve miles distant A large number of icebergs to be seen, occasional fog. Distance by log 74 miles.

Thursday, Aug. 5th.—Fresh breeze from SW. with fog and rain. Steering NW. At five in the evening saw Cape Desolation, distant ten miles. Wind now fresh from W. to W. NW. with light rain. At night strong wind from south and sky overcast. Steering north. Distance by log 180 miles.

Friday, Aug. 6th—Fine weather with fresh breeze from the south. Steering NE. by N. following the coast. All sail set. Saw a few icebergs. Distance by log 180 miles. Lat. 64° 56′ N.

Saturday, Aug. 7th.—A fresh breeze from the NE. during the first part of

day. Steering NE. by N. still following the coast. Later, strong wind and thick fog. Distance by log 144 miles.

Sunday, Aug. 8th.—Strong wind from E. NE., fog and light rain. Steering along the land. Saw several icebergs. Distance by log 158 miles.

Monday, Aug. 9th.—Strong wind from the east with fog. At 5:30 p. m. came to anchor in Disco Harbor. Discovered a plank split and broken off under the starboard quarter. The ship's carpenter and one from shore set to work to repair the damages. The crew employed in getting fresh water and in various duties about the ship.

Tuesday, Aug. 10th.—Fine weather. Carpenters at work on the ship, aided by part of the crew.

Wednesday, Aug. 11th.—Weather remains fine. Employed in various jobs about the ship. Carpenters still at work.

Thursday, Aug. 12th.—Fine weather. Carpenters and crew all busy about the ship. During the latter part of the day light rain and fog.

Friday, Aug. 13th.—Fresh wind from the east with light rain and fog. Carpenters at work on the ship. Crew employed in landing lumber, etc. Later, pleasant with light wind from the west.

Saturday, Aug. 14th.—Pleasant, with light wind. Later, a fresh breeze from the SE with fog. Carpenters at work on the ship, and the crew employed in breaking out and landing lumber.

Sunday, Aug. 15th.—Strong wind from the NE. with rain and fog. At night wind changes to SW.

Monday, Aug. 16th.—During the first part of the day strong wind from the SE. with light rain and fog. Later, the wind shifts to SW. Carpenters still at work. Crew getting rocks on shore for ballast.

Tuesday, Aug. 17th.—Strong wind from the NW., rain and fog. Later, wind still fresh and snowing hard.

Wednesday, Aug. 18th.—Wind from SW., snow, rain and fog. Carpenters and crew still busy.

Thursday, Aug. 19th.—Weather fine and pleasant. All hands employed. Have put on board twenty tons of rock for ballast.

Friday, Aug. 20th.—Weather fine. Carpenters finished work on the ship, and we are ready for the sea.

Friday, Aug. 21st.—Light winds from SW., cloudy. Later, snow and rain. At 9.30 a. m. shipped our anchor and steamed out to sea, bound for Rittenbank. Passed a large number of icebergs. Took a small schooner in tow and a party of ten on board the ship. Light rain squalls at night.

Sunday, Aug. 22d.—Pleasant, with light wind from the west. At 5.30 came to anchor at Rittenbank in thirteen fathoms of water.

Monday, Aug. 23d.—Weather fine. Employed in landing provisions, etc., for Dr. Pavy and Mr. Clay, who are to spend the coming winter here. At night a strong wind from the NW.

Tuesday, Aug. 24th.—Strong wind from the NW. At 6.30 p. m. took up our anchor and steamed out of the harbor for Sakka in search of natives to assist in getting coal. At 11.30 p. m. came to anchor at Sakka in four fathoms of water.

Wednesday, Aug. 25th.—Calm and pleasant during the first part of the day. Later, a strong wind from the N. W. Took a run over to the coal bed but could not land on account of the breakers. Crew employed about the ship.

Thursday, Aug. 26th.—Clear and pleasant with wind from the NW. Took up the anchor and ran over to the coal bed, but again could not land. Strong gales in the straits. Came back to Sakka and anchored in eleven fathoms of water.

Friday, Aug. 27th.—A strong gale blowing from the NW., sky overcast. At 4 a. m. took up our anchor and steamed across to the coal beds. At 7.30 put the second mate with all the crew and thirteen natives ashore, with provisions for two weeks. Capt. Palmer and Lieut. Doane on shore prospecting. Anchored in eleven fathoms of water. A large number of icebergs to be seen. At noon we had taken on board eight tons of coal. Light wind from the SE. at night.

Saturday, Aug. 28th.—Light wind from the SE. and sky overcast. At 3.30 slipped our anchor, as it was impossible to get it clear of the icebergs. Twenty tons of coal on board. Left eight of the crew and twelve natives on shore and steamed back to Sakka. At 11 p. m. cast the lead in seventeen fathoms of water, and at the next cast we were aground on a soft, muddy bottom. At 1 a. m. came off and anchored in seven fathoms of water. Strong wind from the SE. with snow and rain. At 6 a. m. lowered a boat and sounded. Found the bottom muddy and very uneven.

Sunday, Aug. 29th.—During the early part of the day light rain and wind from the SE. At 1 p. m. steamed over to the coal beds. Picked up the anchor we had slipped the day before and went to work getting off coal.

Monday, Aug. 30th.—Weather fine. Employed in getting off coal.

Tuesday, Aug. 31st.—Weather continues fine. Finished coaling, took everything on board, and at 7 p. m. returned to Sakka, where we came to anchor at 11 p. m.

Wednesday, Sept. 1st.—Weather fine. Paid off the natives, 300 pounds of salt beef, and forty pounds of bread. At 10 a. m. took up our anchor and steamed down to Rittenbank.

Thursday, Sept. 2d.—Weather fine. At 2:30 p. m. landed Dr. Pavy and Mr. Clay, with bed and bedding and left for Disco.

Friday, Sept. 3d.—Weather fine with light wind from the SE. Crew employed about the ship. Took on board eight tons of rock for ballast. Carpenters at work on the ship, making repairs, etc.

Saturday, Sept. 4th.—During the first part of the day fresh wind from the SW. and slightly overcast. Later, pleasant with wind from SE. Employed in ballasting the ship, getting water, and various other jobs.

Sunday, Sept. 5th.—Weather cloudy with light wind from the SE. Later in the day, snow and rain with strong wind from the west.

Monday, Sept. 6th.—Fresh wind from the SW. with rain. Crew employed getting aboard water and ballast. Carpenters at work on the ship.

Tuesday, Sept. 7th.—Fresh wind from the NW. with snow. Employed in bringing aboard water and ballast, and scraping spars, etc. Later in the day, light snow and calm.

Wednesday, Sept. 8th.—Clear and pleasant, with light wind from the SW. Busy storing lumber and getting water. At 9 p. m. a Danish barque came to anchor in the harbor. Later, a fresh wind from the NE. and slightly overcast. Finished ballasting the ship, bent the sails, and made ready for sea.

Thursday, Sept. 9th.—During the first part of the day a fresh breeze from the SE. At 3 p. m. took up our anchor and steamed out of the harbor, bound for St. John's, Newfoundland. It was too late in the season to proceed farther north. At 6:30 p. m. called all hands to shorten sail, close-reefed the mainsail and top-sail, banked the fires and hove the ship to with her head to the SW., on the port tack. Gale increasing and a high sea running. Snow and rain. Distance by log 96 miles.

Friday, Sept. 10th—Gale still continues, with snow, hail and rain, and a very high sea. At 10 p. m. clear starlight, barometer still falling. At 1 a. m. began to moderate, and rain commenced falling soon after. At six in the morning started fires and began to run again, steering SW. A little later wind hauled to SW. and we furled all the sails. Light rain and mist, barometer rising. Lat. 67° 56′ N., Long. 58° 30′ W.

Saturday, Sept. 11th.—Light wind from the NW. and a heavy swell from the SE. Steering SW. At 4 p. m. called all hands and shortened sail, and furled all but the fore top-sail. At 8 p. m., weather moderating, saw several large ice-bergs. At 1 a. m. furled top-sail. Sky slightly overcast with a fresh wind from the west. Steering SW. by S. Distance by log 155 miles.

Sunday, September 12th.—Strong wind from SW., snow and hail and a very high sea. At 6 p. m. banked the fires. At 7 p. m. wind changed to NW., with very heavy squalls. Toward morning the weather moderated, kept off S. SW., set the fore topsail and jibs and began steaming again. Strong wind and snow squalls. Distance run by log, from 5.30 a. m. until noon, 58 miles.

Monday, September 13th.—Strong wind from N. NW. and snow squalls. Steering SW., steam and sail. In the middle of the day, light wind from SW. and mist. Furled all sail. Later, strong wind and a driving snow storm. Distance by log, 144 miles.

Tuesday, September 14th.—During the first part of the day light wind from the SW. with rain. In the afternoon wind changes to SE. At 1 a. m. stopped steaming, being short of coal. At 8 a. m. a strong wind from the west with rain. Steering S. SW. Lat. 60° 6′ N., Long. 56° 36′ W.

Wednesday, September 15th.—Fresh wind from the west during the early

part of the day. Steering S. SW. with all sails set. At 2 p. m. strong gales with heavy squalls. Wind W. NW. with a heavy sea; broke the main boom, but rigged it again and set the sails. Steering S. SW. Lat. 58° N., Long. 55° 30′ W.

Thursday, September 16th.—Early in the day a light breeze from the north. Steering S. SW. Middle of the day calm. Later, light wind from the east. All sail set. Lat. 57° 31′ N., Long. 55° 15′ W.

Friday, September 17th.—Weather fair, a light wind from the SE. Ship heading S. SW. At 9 p. m. furled light sails, a little later, close reefed the main sail. Wind blowing heavily. At 12.30 a. m. gale increasing, close reefed the fore-topsail and furled the jib. At four in the morning hove the ship to. A very high sea running and heavy gales.

Saturday, September 18th.—Gale continues with squalls of rain and hail. Moderates in the afternoon. At 4 p. m. set the jib and fore-topsail. Heading S. by W., wind light and a very high sea. At 7 a. m. light wind from the NW. Saw several icebergs. Made all sail, steering south. Lat. 53° 31′ N., Long. 56° 20′ W.

Sunday, September 19th.—Weather fine with a light breeze from the west. All sails set and steering south. Crew employed about the ship. Later in the day, wind from SW., with thin fog. Saw a brig steering SE.

Monday, September 20th.—Calm and cloudy. At 4 p. m. started the fires and began to steam, steering SW. by S. Furled all sail. At 1 a. m. fresh breeze from the NW. and thin fog. Set the jib and fore-topsail. At 3 a. m. a strong gale and a very heavy sea; stopped steaming and banked the fires. At 10 a. m. more moderate. Land in sight, Cape. Lat. 52° 12′ N., Long. 54° 57′ W.

Tuesday, Sept. 21st.—Fresh wind from N. NW. and thin fog. Steering S. SW. All drawing sail set. Saw a barque and brig steering north. At 11.30 p. m. tacked the ship, heading S. SE. Light wind from SW. Lat. 51° 33′ N., Long. 54° 42′ W.

Wednesday, Sept. 22d.—During the first part of the day light wind from the SW. Heading S. SE. Later, strong wind with fog and mist. Reefed mainsail and fore-topsail. Saw a brig heading SE.

Thursday, Sept. 23d.—Strong wind from the SW., with rain. The rain increases. At 3 a. m. light wind from the NW. and fog. Made all sail, steering SSW. Lat. 51° 35′ N., Long. 52° 29′ W.

Friday, Sept. 24th.—Early in the day light wind from WNW., thin fog and rain. Steering S. SW., all sail set. Saw a large iceberg to the north. Island in sight, about eight miles distant. Land ahead on the starboard bow.

Saturday, Sept. 25th.—Strong wind from NW., with squalls of rain and hail. Steaming along the land, all sail set. At 8 p. m. took in sail and half an hour later came to anchor in St. John's Harbor.

Sunday, Sept. 26th.—During the first part of the day strong wind from NW. Later, wind light from the east with rain.

Monday, Sept. 27th.—Wind continues from the east, with rain. Crew setting up rigging, etc.

Tuesday, Sept. 28th.—Strong wind from the south. At 9 a. m. took up our anchor and steamed in to the wharf to get on coal.

Wednesday, Sept. 29th.—Overcast, with fresh breeze from the east. Employed in coaling the ship; hired some hands to assisst.

Thursday, Sept. 30th.—Fresh breeze from the south. At 4 p. m. took a tug and dropped into the stream. Eighty-three tons of coal on board. Three hands came aboard to work their passage to the States. All ready for sea. The day closes with heavy gales and rain.

Friday, Oct. 1st.—The weather cleared early in the morning. The Mail boat arrived at 9.30 a. m. and after getting our mail, took up the anchor and steamed out to sea. One seaman and one fireman deserted. Found a stowaway on board and sent him ashore.

Saturday, Oct. 2d, 1880.—Weather fine and a heavy sea on. At 3 p. m. had to stop to get up steam. Saw several vessels. Later, a fine breeze from the NW. All sails set and steaming. Steering W. SW. Crew employed in washing ship, etc. Lat. 45° 48' N., Long. 54° 40' W.

Sunday, Oct. 3d.—Fine weather, with light wind from NW. Steering W. by S. All drawing sail set and steaming. Saw several sails going east. Coal burning better to-day.

Monday, Oct. 4th.—During the early part of the day a light wind from the east. Steaming W. SW. Later, wind strong from the south. Furled the fore-top sail and reefed the main sail. Lat. 44° 7' N., Long. 63° 48' W.

Tuesday, Oct. 5th.—Fresh wind from the SE., which continues all day. Steering S. SW., using steam and sail. Crew employed in washing ship, etc. Saw four sails. Lat. 42° 7' N., Long. 64° 46' W.

Wednesday, Oct. 6th.—During the first part of the day fresh wind from the S. SE., and cloudy. At 1 p. m., changed the course to SW. by S., and made all sail. At 4 p. m., light squalls from the west. Took in and furled all sails. A little later set fore and aft sails. Heavy rain and thick fog. Steering SW. by W. At 10, cleared off and the wind shifted to W. NW., blowing heavily. Lat. 41° 39' N., Long. 68° 50' W.

Thursday, Oct. 7th.—Clear and pleasant, with strong wind from W. NW. Changed the course to S. by E., and made all sail. The compass has carried the ship two points north of her true course. Later, the wind increased, steering SW. by south., fore and aft sails set. At 4 a. m. passed a steamer bearing east. Lat. 35° 35' N., Long. 69° 55' W.

Friday, Oct. 8th.—Weather fine and a strong wind from the W. SW. Steering SW. with all sails set. At 4:30 p. m. wind hauled to west; furled the square sails. Saw several ships going east. At 2 a. m. a light breeze from the NE. Set all sail. Lat. 35° 14' N., Long. 74° 16' W.

Saturday, Oct. 9th —Fine weather, with light breeze from E. NE. Steering S. by W., using steam and sail. At 1 a. m. made Cape Charles Light. Close reefed the sails and headed the ship south. At 5:30 kept off W. SW., and ran

for three hours. Saw a barge and schooner, both bound for the bay. Later, strong gales and a heavy sea. At noon Cape Henry in sight, four miles distant.

Sunday, Oct. 10th.—Strong gales from the east, all drawing sail set. Steaming up the bay. At 1:45 p. m. took up a pilot. At 3 p. m. furled all sail, wind strong from the N. NE. Anchored off Smith's point, at 12:30 a. m., and at six took a river pilot and proceeded up the river. Weather pleasant.

Monday, Oct. 11th.—Steaming up the river. At 7:30 p. m. came to anchor at Washington.

IMPORTANT DISCOVERIES IN MEXICO.

M. Charnay, now in Mexico, has written the following letter to the *Trait d' Union:*

TULU, Aug. 28th, 1880.

MR. EDITOR:—Since the telegram which I had the honor to send you on the subject of my discovery, I have succeeded in uncovering a Toltec dwelling, of which I write you. To compare Tulu, capital of the Toltecs, to the Roman city is not simply metaphorical; like her she has been buried long centuries, less numerous, it is true; but the Indian (Mexican) Pompeii, though less ancient, is none the less interesting, for she reveals a world unknown, and brings to science and history documents altogether new. Take notice that I do not claim, in any manner, to have discovered Tulu, but I am happy in having been the first person to make intelligent excavations in it. You will judge of the originality of my labors, when I tell you that this Toltec habitation, exhumed to-day from its burial of ten centuries, is composed of twenty-four apartments, two cisterns, twelve corridors, and fifteen small stairways, being altogether of extraordinary architecture and possessed of intense interest. One thing more important, and which will puzzle all tradition. I have found some bones of gigantic ruminants (of bisons perhaps), the tibias of which are 0.35 (metres) in length and 0.10 in thickness, and a femur, the head of which measures 0.14 in length. This is not all; in the midst of samples of every kind of baked earth, from the largest sort, such as bricks, tiles and gutters, to the smaller kind serving for domestic use, I have found some enamels, some porcelain ware, and something still more remarkable; I have found the glass neck of a bottle, ornamented with the colors of ancient Roman glassware. Are these Asiatic keepsakes, or original products? The question is neither new nor the less worthy of the attention of specialists. We have a surprise on the subject of Toltec industry, or a solution of their origin. I make no commentary, leaving to others the care of destroying the consequences of these important documents. As for me, I work, dig, make collections, and reserve my opinions. * * *

DESIRÈ CHARNAY.

—Translated from *L'Exploration* by J. F.

NORTHERN PACIFIC COAL FIELDS WEST OF THE MISSOURI.

From the best information we can obtain, one of the most extensive coal fields on the globe is located west of Missouri river, and along the line of the Northern Pacific R. R. The first outcropping of this deposit is about twenty-six miles west of Mandan, commonly called the Coal Banks; but, so far as prospected, only a three foot vein has been struck. This vein is a lignite—when first exposed—burning with a clear flame, developing somewhat in combustion the characteristics of cannel and bituminous, but not so good as the Pennsylvania or Ohio coal. This is the quality of all the coal undoubtedly in this whole region of country. Forty miles west of Mandan is the extensive mine of Mr. E. H. Bly, proprietor of the Sheridan House, Bismarck, who prospected a large section of country on the line of the railroad last spring. This mine is a seven foot vein, thirty feet below the level of the railroad grade, and dips about this distance in 400. Over this is a four foot vein, and still another above this corresponding with the level at the Coal Banks of three feet. At Green river, 107 miles west of Mandan, is a monster vein of coal of thirteen feet. Mr. Bly in his explorations discovered numerous veins of coal from three to seven feet in thickness, and claims that anywhere in this great area in the bend of the Missouri, to and including the Bad Lands, on the same level, the same veins may be struck. On the south side of the Missouri river, near Fort Stevenson, a subterranean fire has been burning coal for years. Even the Indians have no knowledge of how long, but by report, extending far back, making there miniature Bad Lands like those west of the Green river, where the fires are extinct. There is no doubt that the so-called Bad Lands were underlaid with extensive layers of coal, and that upon burning out the surface settled down, leaving the peculiar characteristics which constitute their present formation. This is at least the accepted theory with those who have seen the process going on in northern Dakota. The question of coal for fuel, for all ages to come, and at cheap rates too, for the treeless prairies of the Great Northwest is settled—and permanently settled. There is enough for all. Mr. Bly has already contracted to get out 25,000 tons the coming season. These coal lands can be purchased of the Government at $20 per acre, and the Railroad Company will sell at the same price. One thing is certain, that no one man or company can ever monopolize this busines. There is too much of it. There will be coal on every 160 acres for 200 miles west and 200 miles south of the Missouri river—in western Dakota.—*Bismarck Tribune.*

Large quantities of pottery are manufactured in Brazil from the hard, silicious bark of the caraipe tree. In the process, the ashes of the bark are powdered and mixed with the purest clay that can be obtained from the beds of the rivers—this kind being preferred, as it takes up a larger quantity of the ashes, and thus produces a stronger kind of ware.

CORRESPONDENCE.

SCHWATKA'S SLEDGE JOURNEY.

(*Copy furnished by the Author.*)

2 ADDISON GARDENS, KENSINGTON, Nov. 6th, 1880.

MY LORD:—In the brief account of Lieutenant Schwatka's sledge journey to King William's island, by Mr. C. R. Markham, in the November number of the Proceedings of the Geographical Society, my name is mentioned, but in such a manner that I feel entitled to be permitted to offer some explanation.

It is said that "several relics of the Franklin Expedition were bought by Dr. Rae in 1854 from the natives and *sent* home."

What Mr. Markham, with that propensity for unfairness for which he is notorious, is pleased to call "*several relics*," not sent, but brought, home by me, consisted of more than seventy articles, among them twenty-three silver spoons and forks, nine pieces of silver watch cases, one case of a silver-gilt chronometer and dial, two pieces gold watch cases, two pieces gold watch chain, sovereigns, half-crowns, shillings, etc. On some of these articles were the initials or crests of thirteen of the officers (there were sixteen officers in all) and the names of two of the men, "Hickey" and "Fowler."

In addition to these was a cross of the Hanoverian Order of Knighthood, and a small silver plate with Sir John Franklin, K. C. H., engraved upon it.

These relics are deposited in the painted hall at Greenwich Hospital, and taken altogether are, with the exception of the record obtained by the Fox Expedition of 1858–9, equal, at least, in importance to all that has been brought home by subsequent explorers, and were sufficient, in combination with my plain, unvarnished report, to elicit from the Lords of the Admiralty a letter by their Secretary, dated 24th of October, 1854, in which the following paragraph occurs: "I have to request you will inform Dr. Rae of their Lordships' high approval of the services of Dr. Rae, *who has set at rest the unfortunate fate of Sir John Franklin and his party.*" (See letter No. 4, page 834, Arctic blue book 1855.)

As regards the more painful part of the information obtained by me; had any one heard and *seen* as I did, the Eskimos tell what they had to say, they could not, *if impartial*, have failed to believe that they spoke the truth. Had I not reported *all* that was told me, my men would have done so, and *did*, and I might have been justly accused of withholding a part. I found on my return from my fifty-six days' sledge journey, that the three men left in charge at Repulse Bay—none of whom could understand or speak a word of the language—had been already informed by natives, who had been for some time occupied near them, of all the most important sad details by pantomime or dumb show.

I may have added that these strangers, twelve strong men, some of them from the West, had lived on the most friendly terms with my three fellows (who had constantly to be separated one from the other) and had not stolen or attempted to steal a single article, although some guns, boxes of saws, knives, files, daggers, etc., were lying on the rocks, covered and protected by only an oil cloth. Had these Eskimos been so inclined, they could have easily murdered my men, destroyed our boat, and carried all our property away beyond my reach, and left us in a very precarious position, as I was not placed as Hall and Schwatka were, namely, within a few days' journey of a ship, but 700 or 800 miles distant from any assistance. Had they murdered any of Franklin's people, as has been hinted, would they not have done the same to my men, where the temptation must have been very great?

We are given an extract from the writings of Admiral Shevard Osborn, as follows: "We know that the surmises and assertions of savages are false." This may be true of many savages—especially those who have come in contact with civilization—but it is not so with the Eskimos, for my own experience and that of men who have seen much of these people at Labrador, East Main and Churchill lead me to think that it would be unjust, nay, almost an insult, to the poor "Innuit" to class him with the average Englishman for untruthfulness. Were it convenient to do so, I could give some striking illustrations of what I state; yet no further proof seems wanting than the disgraceful disclosures of bribery, falsehood and corruption at present being brought to light in connection with recent elections of certain Members of Parliament, among men from whom something better was to have been expected.

The cravings of hunger become as irrepressibly painful to some men as the irresistible desire for alcohol by the drunkard or for opium by the opium-eater, both of whom know to what misery their excesses must lead, yet they cannot abstain. These failings are certainly a disgrace and reproach to those possessed of them, whereas to have recourse to the most repulsive of food, in a few of many cases of starving men, when the craving amounts to a kind of madness, is assuredly a misfortune, rather than a reproach. Had some of my dearest friends been among the Franklin party, I should have felt bound, in honesty, to tell the story as I told it.

I have myself witnessed this painful craving for food in one or two cases when provisions ran short, and the most objectionable food would have been eaten, although I never had this terrible feeling myself, even when forced to "chew up" pieces of skin and ptarmigan bones up to the beak and down to the toe-nails. It is further stated that one of the officers seen alive was a "*Doctor.*" This is probable enough, but the evidence on which Lieut. Schwatka founds this belief is envious, and possibly not quite reliable. The Eskimos told him that the word Dook-dook was spoken by one of the white men, "an officer," and this was interpreted to mean "Doctor." Now Dook-dook or Took-took is the Eskimo name for "*deer,*" and was reported to me, in 1854, to be used in this meaning, when

one of the white men, "a chief," was attempting to tell the natives that they were going to the great land to the south to shoot deer—thus: "Took-took-pung—imitating the report of fire-arms and pointing to his gun." This is the note I find in my original journal: Which is the right interpretation, "Doctor" or "Deer?"*

The date of the white man having been seen is given by Lieut. Schwatka as 1849; whereas, the record found by McClintock shows clearly that the date of leaving the ships was April 1848. How Schwatka or anyone else could get a date with any degree of accuracy from the Eskimos after a lapse of thirty years, I am at a loss to understand, and equally so, why these poor suffering men, if alive in 1849, should have remained on King Williams Island or on the main land northwest of Backs River, instead of embarking in their boat or boats and pushing southward on the open water that it is reasonable to suppose must have existed some time during the summer of 1848.

My opinion is that the expectations of these unfortunate men, were vainly founded on the belief that the ice would break up and that the Back River would be navigable much earlier than was really the case; such opinion being formed by them on a knowledge of the breaking up of the ice and navigability of the Coppermine River, 20 degrees further west, which occurs a fortnight or three weeks earlier than at the Republic Bay, or at the Back River. A detention of three weeks would cause, in all likelihood, a fatal and unexpected expenditure of provisions and strength.

Even were it true, as a writer on the *Times* says, that six months or even a years' rations might have been saved out of the three years stock on board—a most unlikely thing—it is very evident that however much provisions were on board, the quantity taken on the sledge journey would be limited to the amount the poor fellows were able to haul or carry, and when that was nearly or wholly expended, they would not be in a very fit condition to go perhaps 140 miles back to the ship for more.

When I was at Republic Bay in 1854, the Eskimos had heard nothing of the ship said to have sank near Point Grant, nor did they know anything of the white men found in 1859, (five years afterward) on King Williams Island by Hobson and McClintock, because the many articles found in the boat would have been removed and the boat broken up, as was afterward done.

The only white men I heard of were the "at least forty" who reached the low, flat shore of the main land, about a long day's sledge journey with dogs, northwest of the mouth of Back River. These men hauled one or two boats with them, were making very short days' marches, pitched tents to sleep in, and were all looking thin, and were probably the last survivors of the ill-fated expedition.

It was from the place where these dead were found that all the relics brought home by me were taken; it was here also where ten or twelve books were seen,

* The Eskimos have a frequent practice of introducing themselves by patting their breasts and telling their names. They may have thought that the white chief was doing the same.

which being for no use, were given to the children to play with and torn up and destroyed.*

The Eskimos (in 1854) said it was curious that although sledges had been seen with the party when traveling, and their tracks on the ice noticed, no sledges were found where the dead men were, although the boat or boats were there. I asked if there were any signs of fire. They replied: Yes. I then explained that as the white men had reached the mainland "Noo Nah" at no great distance from the river they wished to ascend, they did not require the sledges any more, and probably used them for fuel. The explanation seemed satisfactory, as certified by a bright look of intelligence. To us the absence of the sledges would appear of slight importance, but to an Eskimo a large wooden sledge is a grand prize; hence, their absence puzzled them.

I have now to apologize for troubling your lordship with this very long letter, a penalty imposed in consequence of the high position you so worthily hold as President of the Royal Geographical Society. I have the honor to be

Yours respectfully, [Signed.] JOHN RAE.

The President Royal Geographical Society.

Note to the Editor of the KANSAS CITY REVIEW.

Two of the instances of falsehood, (both told with the laudable (?) object of exalting the position of the men and officers of her majesty's navy, at the expense of others who have explored on the Arctic coasts), I think it now *convenient* to add to the foregoing letter. The author of the Northwest passage by McClure, (McClure himself is not responsible) an Admiral in the navy, not long dead, filled a page of the book with a notice of the Arctic work of myself and my Hudson's Bay voyagers, every word of which is false, and willfully so, because this man was informed that his statements were erroneous and proof given to that effect, yet he refused to make a correction in the second edition of the work. Another Admiral who not very long ago was hydrographer to the admiralty and is still living, stated plainly to a very large meeting of our geograpical society, that no Arctic explorers, except those of Her Majesty's service, had ever done any good geographical work!! At the time that this statement was made, five gentlemen, having no connection with the English navy, had received the highest honor that could be bestowed for their Arctic researches—namely:

Thomas Simpson—Founders' Medal 1839, for less *than half* his Arctic work accomplished at that date.

John Rae—Founders' Medal in 1852, who did nearly as much more work afterward. His survey of Wollaston and Victoria Lands were found so much more accurate than the subsequent survey of Captain Collinson, that his survey was not only adopted on the admiralty charts—names and all, but was used to illustrate Collinson's report in the Arctic blue book.

Dr. Kane—Founders' Medal, 1856.

* This story is repeated to Schwatka exactly as it was told to me twenty-five years before.

Dr. Hayes—Patrons' Medal, 1867.

Professor Nordenskjold—Founders'Medal, 1869.

Here we find four of the above five names, obtaining the Founders' or first gold medal for their Arctic work, in precedence of distinguished explorers in other parts of the world.

There can be only one of two conclusions that must be come to; either this Admiral must have said what he knew to be false, or the council of the Royal Geographical Society, probably as just and as competent a tribunal as is to be found in the world, has given its decision unjustly and foolishly to men of whom they had little personal knowledge—for Simpson and Rae had lived half their lives in the wilds of Hudson's Bay, whilst Doctors Kane and Hayes were Americans.

Here are two instances of direct untruths, told with a very paltry and mean object, by men holding the highest position in our navy, yet these very men, forsooth, accuse the Eskimos of falsehood, of surmise and assertion. J. RAE.

THE OLD IN NEW MEXICO.

SANTA FE., N. M., Oct. 10, 1880.

The trip to New Mexico, which, within the memory of very young men, was a three months' toilsome journey from Kansas City, in "prairie schooners" drawn by diminutive mules or broad horned oxen, is now a matter of romance as one glides along over the Atchison, Topeka & Santa Fe Railroad, and gazes out of the windows of his Pullman car upon lovely prairies, well cultivated farms, herds of blooded cattle and sheep, and searches in vain for that *ignis fatuus* of of geographers, the Great American Desert.

Without rehearsing the well known story of the attractions and advantages of Kansas, and the boundless mineral wealth of Colorado, we will at once take up that of New Mexico, which territory, as some writer has aptly said, "is entered through a hole in the ground," meaning the tunnel through the Raton Mountains, at whose mouth runs the boundary line between Colorado and New Mexico. This tunnel is 2,000 feet long, through the hardest of granite, and is a fine specimen of engineering enterprise and success.

From the tunnel we pass swiftly to the plains of New Mexico, and over an almost level road, we descend in clear view of the snow-clad Mexican Cordilleras in the distance, and the nearer foot-hills, often capped in fantastic shapes with pyramids, and cones, and abrupt steeps.

We pass several Mexican hamlets, from which the ever-curious, tawny-faced women and children, dressed in bright colors or in plain black, look out from their abodes in huts upon the passing wonder. And it is indeed a wonder to see a long, full train of cars, with Pullman sleepers, traversing the ancient plains of the Pueblos, the realm of the Montezumas. About noon we cross miles of lava beds, whose black, broken masses cover the ground; and, at a distance to the west, we see the walls of a mighty mountain-crater, with the side open to the

east, from which the melted torrent evidently flowed. Ordinarily this plain is covered with a fair growth of a very nutritious bunch-grass, which affords pasturage to vast herds of cattle and sheep, but owing to the total failure of the summer rains, there was no grass crop this year nor vegetation of any other kind. As an example of the truth of the adage that "it never rains but it pours," the rainfall for the month of August, 1880, at Las Vegas, was eighteen inches. All the settled portions of the country are traversed by irrigating ditches, which are now as dry as the plains, but which show the traveler how farming is conducted here in ordinary years. Little patches of wheat and potatoes can be raised, by careful and patient tending, where a sufficient water supply can be had for irrigating purposes, but a farmer of Illinois, Missouri or Kansas can raise a bushel of grain and ship it into the Territory cheaper than a New Mexican farmer can raise the same quantity under the most favorable conditions,. This fact settles the agricultural status of the Territory, and proves that New Mexico, as well as Colorado, must always depend for its bread and provisions upon the great agricultural district embraced within the limits of Illinois, Missouri, Iowa and Kansas. The people of all this vast mineral belt in the Rocky Mountains must inevitably be fed by the great agricultural States of the West.

The mineral resources of New Mexico, however, are practically inexhaustible, and though the Americans have only just begun to invade the Territory, discoveries of gold and silver are reported every day, and in every part of the country. The character of the mineral deposits, in all sections of the Territory, is such as to render considerable capital necessary in order to work the mines with any degree of success.

The towns of New Mexico are curiosities to the American. Las Vegas, for instance, is a place of about 5,000 people—or more properly, two places of about 2,500 each, for it is, in fact, two distinct towns, thoroughly dissimilar in every particular. The "new town" is on the railroad, has broad streets running at right angles, its houses are of frame, generally painted white, and the place has a familiar American look, while the people are all Americans. The "old town," situated about a mile from the road, is different in every aspect, is inhabited by a different kind of people, and looks as though it belonged to an entirely different race and age. Like all the other towns in the Territory, except the three or four that have been put up by the Americans since the railroad came in, it is built around a public square, or plaza; the business of the town is all done on the four sides of the square; narrow streets, or roads, diverge from each corner of the square and lead out into the country, but these, like the cross streets, where there are any, are not more than twenty-five feet wide, are without sidewalks, and are alleys rather than streets. All the houses—business houses as well as residences—are built of adobes—sun dried brick—are one story high, with walls usually about three feet thick, and with flat roofs covered with earth. All the business houses are on the Plaza, while on the alleys or roads leading out from this the residences are situated.

At Las Vegas (the Meadows) we took a carriage for the famous Hot Springs, five miles distant; and, passing directly through the old Mexican city, which still divides with Santa Fe the trade of Northern New Mexico, and which commands the bulk of the enormous wool business, we made our way past several ranch-villages belonging to the old and aristocratic Baca family, to the cool and beautiful cañon in which the springs are located, and were soon domiciled in the excellent hotel there. As these springs are worthy of especial mention, and are not generally known at the East, I will devote some space to their description. The springs are twenty-two in number, and are all found within an area of about ten acres, near the left branch of the Gallinas River, and perhaps half a mile from the mouth of the cañon. They have been, from the time "whence the memory of man runneth not to the contrary," a famous sanitary resort among the Castilian, Mexican, and Indian races inhabiting this region.

These springs rise not far from the mouth of a beautiful cañon, which opens upon the plains four miles above the city of Las Vegas, and from that point winds romantically into the Spanish Range of the Rocky Mountains, the latter extending one hundred and fifty miles southward from the Colorado line into New Mexico. The Springs have an altitude of 6,400 feet—the elevation which has made Colorado such a favorite resort for those affected with pulmonary complaints—with a decided advantage over some of the northern resorts as to latitude and health-giving climate. The character of the waters is similar to that of the famous Hot Springs of Arkansas, as shown by the following chemical analysis, made by Prof. F. V. Hayden, United States Geologist:

Constituents.	Spring No. 1.	No. 2.	No. 3.
Sodium Carbonate	1.72	1.17	5.00
Calcium Carbonate, Magnesium Carbonate,	1.08	10.63	11.43
Sodium Sulphate	14.12	15.43	16.21
Sodium Chloride	27.26	24.37	27.34
Potassium	Trace.	Trace.	Trace.
Lithium	Strong trace.	Strong trace.	Strong trace.
Silicic Acid	1.04	Trace.	2.51
Iodine	Trace.	Trace.	Trace.
Bromine	Trace.	Trace.	Trace.
Temperature	130° F.	123° F.	123° F.

Fifty miles from Las Vegas we come to Baughl's station, where we stop over to explore the ruins of the Pecos church and village (described in the November number of the Review). After spending nearly three days in this interesting work, we again take the train and move on to Santa Fe. The scenery along the whole line, from the Raton tunnel to Santa Fe, with its charming pine-decked valleys and hill sides, its distant purple ranges of mountains and its occasional snow-clad peaks, is very beautiful, while such special objects as the Raton Pass, the Moro Cañon and the Apache Pass are grand and striking.

Santa Fe is about eighteen miles off the main line of the A., T. & S. F. R. R., and is reached by a branch road which has some remarkably steep grades

This old town is probable the oldest in the United States, having been a populous place when the Spaniards found it in 1542. Its citizens claim that it was then known as Cicuyé, but other authorities believe that the old Pecos village was the true site of Cicuyé. Schoolcraft makes no doubt of this, and gives, in his history of the North-American Indians, an engraving of the old church and surroundings under the title of "Cicuyé or Pecos."

The city lies on the edge of a basin of the mountains, and viewed from the summit of a neighboring peak, looks like a vast collection of brick kilns. The houses are mostly of adobe, one-storied, squarely built, and the smoke curling from their tops assists the appearance named. The Santa Fe river—called river by courtesy, for the stream is no wider than you can leap across—flows through its midst.

Its early name was "the city of San Francisco Asis de Santa Fe," Saint Francis being the patron saint. Later it was called "La Ville Real de Santa Fe," which has been reduced to simple Santa Fe, "Holy Faith." Its population now is about 6,000. Its latitude is 35 deg., 41 min., its longitude 106 deg., 10 min., and its altitude 7,000 feet. Its time is one hour, fifty-six minutes and four seconds slower than Washington time.

Among the objects of interest is the Governor's palace, which was erected previous to 1581, from the material of the old town, one story in height and some two hundred feet long, with a piazza along its whole front. It has the appearance of an adobe structure whitened with lime wash. It is nearly two hundred years older than Independence Hall in Philadelphia, and is to this time occupied by the Governor of the Territory. Another attractive object is the San Miguel church, also built of adobes, and more than two hundred and fifty years old. Across the street is the oldest dwelling house in Santa Fe, said to have been built before the visit of Coronado, in 1540. It is of adobe, 60 feet long, 12 high and 15 wide, and is still occupied by several families. The Bishop's Cathedral is now being constructed in modern style, and incloses the old adobe church which will be torn away when the Cathedral is finished.

Guadalupe chapel is another relic of the past, being an adobe building with smooth walls, and surmounted by a diminishing tower formed of mud pillars and containing an antique bell.

Everything about Santa Fe except the railroad and the plaza, which is planted with shade trees and inclosed by a neat fence, is antiquated and foreign.

At Albuquerque we strike the Rio Grande, and along its narrow valley, by means of irrigating canals, the various cereals are raised, as well as apples, peaches and grapes, the last named being of very superior quality.

Near Alamilla station, about fifty miles below Albuquerque, is a Pueblo village consisting of a hundred or more huts. Close by is an immense lava rock profusely decorated with rude drawings of animals, boats, etc., and in a cave near are paintings in black, red and yellow colors representing, among other

things, a human figure shooting lightning from his mouth upon the head of another who seems to be prostrated and stunned by it.

The whole region tells of a civilization which was, in its day, far superior to that of the present, and nearly every day new discoveries are made by the hardy prospectors that would delight the archæologist's heart. C.

SCIENTIFIC MISCELLANY.

AMERICA'S RIVER SYSTEM ARTIFICIALLY DEVELOPED.

Has any fanciful person, with a commercial turn of mind, and with a deeper interest in the development of the great trade avenues which nature has marked out than in the highways constructed wholly by human art and mechanism, ever taken the trouble to imagine what the river system of America will be when perfected as it may be, and as it doubtless will be, when the lapse of centuries shall make this the populous country of the world and masterful in art, commerce, and all science?

To map out in fancy all the schemes which must seem not only feasible, but likely to be accomplished as time passes—unless a new motive power be discovered which shall vastly cheapen all present modes of transportation—cannot but seem Quixotic to the ordinary and unfanciful observer, while, in fact, their accomplishment would not embody a tithe of the extraordinary features that have been contained in the modern application of steam, and the utilization of many other recent expositions of science. Probably no fact was ever developed which long anterior to that development did not have its counterpart in fancy, and, therefore, no picture which plain natural law does not declare to be outside of the realms of the possible, should be thought an exaggeration—a mere vision, possessing no phase possible of fulfillment.

If, therefore, any enthusiast be heard to prophecy that the United States—which will then doubtless include all of North America—will one day be traversed by steamships from the Atlantic to the Pacific, and from the lakes of British America, the great lakes, the eastern rivers, and the streams running down the western mountains of the Gulf, he should not be condemned as a fool or a visionary without a close examination of the map of North America, and without indulging in serious speculation as to what engineering, in its wonderful progress, is capable of accomplishing.

Let such an enthusiast have full sway, and he will explain to his audience first how the rivers of the East may be utilized for steam navigation. New England has several rivers which might be improved so that navigation would be extended much farther into the interior than at this time. In New York the Hudson, with its broad expanse, rolls down from the beautiful lakes which lie

adjacent to the St. Lawrence, and these in turn have streams flowing into them which could be easily made a connecting link between the river which is the pride of New York and that greater one which carries the waters of our vast inland seas through British territory to the Atlantic Ocean.

Coming to Pennsylvania, we find a vast field for the exercise of that theoretical river improvement which may one day become a fact. The Delaware and Schuylkill could be utilized to a far greater extent than at present, though they could not be transformed into important connecting links with other waters, as some of their sister rivers may be. The Susquehanna offers the most splendid inducements to the theorist. Its head waters lie so near the smaller lakes of New York, which might easily be connected with the great lakes, that any one can see what a grand commercial avenue it could be made. If its own waters, by judicious conservation, should be found insufficient for the use of vessels, an ample supply could be had from the lakes, which would be tapped. Again, the Susquehanna could be wedded to the waters flowing to the Gulf by the route proposed by General Harry White, or by some other way which a survey would discover to be feasible. Any who have traversed the line of the Pennsylvania Railroad will doubtless know how readily the waters of the Juniata and Conebaugh could be united, the former leading to the Susquehanna, and the latter to the Allegheny by way of the Kiskeminitas.

Again, the Allegheny, with its great volume could easily be made a connecting link between the Ohio and the great lakes, first by tapping Chautauqua Lake to mingle with its head waters, and then by uniting Chautauqua with Erie by a canal of eight or ten miles in length. This could be made one of the most magnificent water ways in the country, and would be a great avenue for commerce.

There are several other schemes besides the one mentioned for joining the Atlantic with the Gulf waters. One contemplates a union of the head waters of the Youghiogheny and the Potomac, another the connection of the Monongahela with another branch of the same stream, another a junction of the Kanawha with headers flowing into the Atlantic. All of these schemes look to the grand desideratum of uniting the navigation of the western rivers with that of the Atlantic Ocean. Of course, before this is done, or before such a brilliant intermarriage of rivers could be made to bear fruit, the Ohio, at least, if not the Mississippi, would have to be improved, so that it could be utilized at other times than when the spring freshets, the summer solstice, or the summer equinox, furnish a sufficient supply of water to float a flatboat laden with coal.

Going west to the Mississippi, examination of its northern course shows how readily, in a day of great engineering, that Father of Waters might be connected with the greatest lake in the world, thus completing a grand avenue for commerce between the North Atlantic and the vast agricultural regions of the South and West. West of the Mississippi the powerful mind will not lack for similar food for speculation in tracing the possibilities of uniting the waters of the Missouri,

Red, Rio Grande, and other rivers, with those of streams having their origin high up on the Pacific water shed.

Those interested in these matters, and others not immediately or practically interested, may find instruction and diversion in an examination of a map clearly defining the rivers of North America, and estimating the work necessary for uniting them to form a network of avenues for steam navigation extending over the whole country. It is a work for centuries, though, and not for years—we had almost said for eternity, and not for time. Yet we can hardly avoid feeling that this is a part of the America of the future. When the great railway lines are all completed, and there are several of what are, by way of distinction, called "competing lines" between the Atlantic and the Pacific, and between the far North and the far South, and when the railway kings of a half century or a century hence "pool their issues" to fleece the public, then that public, three times as numerous and as wealthy as now, will begin to realize, if not before, that there must be some method of transportation of freight which will check the action of railway companies in imposing onerous tariffs. These modes of transportation will necessitate the employment of either water or air, and as the latter element does not promise richly in this particular, the development of rival methods will doubtless be confined to the water.

The keenly-observant reader may see in all this speculation a satire upon river improvement, and when it is considered how the government temporizes in the matter of river improvement the person who indulges in a fancy so far extended beyond that which is at present a subject for somuch discussion and so little action, may well be accused of attempting a satire. But we believe that the public mind will wake in the near future to the advisability of great improvements in our water ways, and that, as the years now far distant roll by, the increased wealth, population, and energy of America will bring about the perfection of the system for steam navigation which we have fairly outlined, and which now seems a mere figment of the imagination.—*River Record.*

THE SUCCESSOR OF GENERAL MYER.

As yet President Hayes has given no indication of his purpose with regard to the choice of a successor for General Myer as Chief of the Signal Service. It is stated, however, on apparently good authority, that the position is to be given to one of two or three regular army officers, who have never had any connection with the bureau, and who strive for the place as a pleasant and easy berth rather than as a post of great capacity for useful and eminent service. The President will make a great mistake if he allows the Signal Bureau to lose any part of its usefulness, and by putting it in charge of any one whom the newspapers have recently named for it he will do this very thing. He will make it a sort of brevet pension office. The right way to fill the vacancy would be to promote the best of the subordinates of the late General Myer, whoever may prove upon a thor-

ough review of the situation to be entitled to this designation. There are men in this branch of the service who have been there from the beginning—who aided General Myer while he lived and who are entitled to divide with that eminent gentleman all the honors earned by the bureau as a whole. It is idle to say that among these can not be found one who is better qualified than any merely military man can be to fill the vacancy now existing. The Signal Service has done great good in the past and is capable of immensely greater good in the future To be worthy of its past or hopeful as to its future, however, it must be managed and directed on correct business principles—the very first of which is that the man best fitted for its control shall be intrusted with its control, and that it shall not be treated as a prize to be bestowed upon a personal friend or as a reward for merit, however great, in some department of public service entirely disconnected with its duties.—*St. Louis Globe-Democrat.*

NECROLOGY.

DECEASED 1880.

ANDREWS, PROF. E. B., Lancaster, Ohio. Died Aug. 21, 1880.
ANDREWS, KITTIE GALLUP, Vineland, N. J. Died May 10, 1880.
AUSTIN, C. F., Closter, N. J. Died May 18, 1880.
BARKER, DANIEL, Norfolk, Va. Died Aug. 23, 1879.
BOWERS, MRS. STEPHEN, Santa Barbara, Cal. Died Sept. 1879.
BREWER, THOMAS M., 233 Beacon St., Boston.
BREWSTER, CHAS. G., Boston, Mass. Died 1880.
BUMSTEAD, FREEMAN J., M. D., New York. Died May 28, 1879.
BURBANK, L. S., Woburn, Mass. Died Aug., 1880.
CASSELS, J. L., Western Reserve Coll., Hudson, Ohio.
CHAPMAN, W. B., Cincinnati College, Cincinnati, Ohio. Died 1874.
COOKE, CALEB, Peabody Acad. Sci., Salem, Mass. Died June 5, 1880.
EBERSOL, D. S., Sec. Acad. Nat. Sci., Ottawa, Ill. Died April 10, 1880.
FROST, CHAS. C., Brattleboro, Vt. Died March 16, 1880.
GUNTHER, O. R., Curator Nat. Hist. Soc., Worcester, Mass., Died 1880.
HALDEMAN, DR. S. S., LL. D., Prof. Comp. Philol., Univ. of Pa., Chickies, Pa. Died Sept. 10, 1880.
HUNT, EDWIN, Ph. D., Utica, N. Y. Died 1880.
JOHNSTON, JOHN, Prof. Chem., Wesleyan Univ., Middleton, Conn. Dec., 1879.
KEDZIE, PROF. W. K., Oberlin College, 1880.
LANE, J. HOMER, Coast Survey, Washington, D. C. Died April 24, 1880.
LASSEL, WILLIAMS, F. R. S., Astronomer, died Oct. 4, 1880.
LINDHEIMER, FERDINAND, New Braunfels, Tex. Died Dec., 1879.
MEIGS, PROF. J. H., M. D., Philadelphia, Pa.
MILNER, J. W., Waukegan, Illinois.

XUM

MUDGE, BENJ. F., A. M., Manhattan, Riley Co., Kansas. Died Nov. 22, 1879.
MYER, GEN. A. J., Chief Signal Officer, U. S. A. Died April 24, 1880.
PATCH, HARRY H., Salem, Mass. Died Aug. 16, 1880.
POURTALES, L. F., Mus. Comp. Zoöl., Cambridge, Mass. Died July 17, 1880.
SMITH, GREENE, A. M., Peterboro', Madison Co., N. Y.
STAUFFER, JACOB, Lancaster, Pa.
TREADWELL, HOWARD, M. D., Ph. D., New York.
WATSON, PROF. JAMES C., University of Wisconsin, Madison, Wis. Died Nov. 23, 1880.
WELLINGTON, C. W. W., Hyde Park, Mass. Died Aug., 1880.
WOODWORTH, JOHN M., M. D., Washington, D. C.

BENJAMIN PEIRCE: ASTRONOMER, MATHEMATICIAN.

1809–1880.

BY OLIVER WENDELL HOLMES.

For him the Architect of all
Unroofed our planet's starlit hall;
Through voids unknown to worlds unseen
His clearer vision rose serene.

With us on earth he walked by day,
His midnight path how far away!
We knew him not so well who knew
The patient eyes his soul looked through;

For who his untrod realm could share
Of us that breathe this mortal air,
Or camp in that celestial tent
Whose fringes gild our firmament?

How vast the workroom where he brought
The viewless implements of thought!
The wit how subtle, how profound,
That Nature's tangled webs unwound;

That through the clouded matrix saw
The crystal planes of shaping law,
Through these the sovereign skill that planned,—
The Father's care, the Master's hand!

To him the wandering stars revealed
The secrets in their cradle sealed:
The far-off, frozen sphere that swings
Through ether, zoned with lucid rings;

The orb that rolls in dim eclipse
Wide wheeling round its long eclipse,—
His name Urania writes with these
And stamps it on her Pleiades.

We knew him not? Ah, well we knew
The manly soul, so brave, so true,
The cheerful heart that conquered age,
The child-like, silver-bearded sage.

No more his tireless thought explores
The azure sea with golden shores;
Rest, wearied frame! the stars shall keep
A loving watch where thou shalt sleep.

Farewell! the spirit needs must rise,
So long a tenant of the skies,—
Rise to that home all worlds above
Whose sun is God, whose light is love.

Atlantic Monthly, December, 1880.

BOOK NOTICES.

"BULLETIN DE LA SOCIETE DE GEOGRAPHIC D' ANVERS."

We have before us three elegant numbers of the Transactions of the Belgian Geographical Society at Antwerp. This society, though established as recently as October, 1876, seems to be one of the best working institutions of the kind in the world, and scarcely equaled in the long lists of distinguished scientists, who are its active or corresponding members, by any other geographical organization. Among the numerous interesting subjects discussed, we notice Mural Geographical Paintings, Transportation from the Commercial Centers of Equatorial Africa, A Conference with Mr. De Lesseps on the Panama Canal; also, a most attractive article on the Chartography of the Ancients, or the Map-making and Geographical Knowledge of the Ancients. In this article, we find reproduced the rude maps of the Assyrians, Egyptians and Greeks. The pleasure we experience in looking over these transactions leads us to hope we shall be favored with the perusal of the future publications of the Geographical Society of Antwerp.—(J. F.)

BULLETIN OF THE PHILOSOPHICAL SOCIETY OF WASHINGTON, vols. I, II, III. Washington: Government Printing Office.

This society was organized March 13, 1871, and Prof. Joseph Henry wa elected its first president. The objects of the society were stated by him to em brace the study of all those branches of knowledge that relate to the positive facts and laws of the physical and moral universe, and accordingly we find in the pro-

ceedings articles and abstracts of articles upon astronomy, physics, chemistry, biology and natural history, contributed by most of the learned scientists of the national capital.

The present officers are: Simon Newcomb, President; J. K. Barnes, J. E. Hilgard, W. B. Taylor and J. C. Welling, Vice-Presidents; Cleveland Abbe, Treasurer; C. E. Dutton and Theo. N. Gill, Secretaries.

THE STUDENTS' GUIDE TO PRACTICAL DRAUGHTING: By T. P. Pemberton. Industrial Publication Co., New York, 1880, pp. 112, 12 mo., $1.00.

This is a small, but thoroughly practical work, by an expert of many years' actual experience, who knows just what beginners need. His directions regarding the necessary instruments and appliances are careful, precise and full, his suggestions practical and valuable, and the whole book will be found eminently useful to machinists, mechanics, apprentices and students.

THE NATURALISTS' DIRECTORY FOR 1880: Edited and published by S. E. Cassino, Boston, 1880: 12 mo., pp. 152, $1.00.

This well-known work is presented this year in an enlarged form, and contains the names, addresses, special departments of study, etc., of more than four thousand naturalists, chemists, physicists, astronomers, etc.; also, lists of the prominent scientific societies, periodicals and books of the United States and Canada, revised and perfected to October, 1880. Mr. Cassino has done this work well, and has made the Directory almost indispensable to naturalists of all classes. Next year he expects to enlarge it, to include, as far as possible, the scientific men and periodicals of the whole world.

MIND AND BODY; THE THEORIES OF THEIR RELATION: By Alex. Bain, LL.D. THE WONDERS OF THE HEAVENS: By Camille Flammarion. Translated by Mrs. Norman Lockyer.

These two valuable works constitute numbers XIII and XIV of the Humboldt Library, published by J. Fitzgerald & Co., New York. It is unnecessary to speak especially of them, as the authors' names and the titles of the works are sufficient to guarantee them a rapid sale at the low price of fifteen cents each.

QUARTERLY REPORT OF THE KANSAS BOARD OF AGRICULTURE: By Joseph K. Hudson, Secretary, Topeka, Kans. Octavo, pp. 156.

As heretofore, this report contains valuable statistics relative to population, wealth, acreage of crops, condition of farm animals, crops, orchards, meteorological data, etc., together with papers by well-known writers on the breeding, management, feeding and grazing of cattle in Kansas; information on the treatment of milk cows, manufacture of butter and cheese, etc.

No better means of advertising can be adopted by any State than this, and very

few men are as well calculated to prepare suitable statistics for the reading immigrant as Major Hudson.

PROCEEDINGS OE THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, Part I, April to September, 1880: Octavo, pp. 352.

This volume is unusually full of articles based on original work and investigation by the members of this, one of the oldest academies in the United States. Among them we find the well-known names of Professors Leidy, Rand, Lewis, Meehan, Jefferis, Drs. Chapman, Hartman, Allen, etc., etc.

ATTI DELLA SOCIETA TOSCANA DI SCIENZE NATURALI, Residente in Pisa.

We have before us the 4th volume of the Transactions of the Tuscan Society for the Natural Sciences of Pisa. It is taken up with the discussion of pure science, or such topics as can only interest specialists. Among the numerous subjects presented, we notice Fossils of the Lower Lias of the Central Appennines; Chemical Study of Heulandite and Stilbite; Action of Heat on the Mixture of Iso-butyrate and Formate of Calcium; New Fossil Teeth of the Notidanus; Histological Study of the Complementary Sexual Organs of some terrestial Mollusks; Oölitic Fossils of Mount Pastello in the Province of Verona; Pliocene Fossils of the Echinodermi, etc., etc. These papers are beautifully illustrated, and as specimens of typography and lithography can scarcely be equaled. The Transactions of this Italian society will be perused with intense interest by all specialists in the study of Natural Science. J. F.

METEOROLOGY.

KANSAS WEATHER SERVICE—STATION, TOPEKA.

OBSERVER, PROF. J. T. LOVEWELL.

The meteorological record herewith submitted is for the month beginning October 20th and ending November 20th. The tables below present the summary by decades, as well as the mean daily average for the whole period of thirty-one days.

It will be noticed that the temperature of the second decade in November is much lower than the two previous decades. The rainfall has been very light, $1\frac{61}{100}$ inches, and no snow, except enough to whiten the ground, on the 16th.

The prevailing winds have been northwest and north. Brilliant solar and lunar halos were seen on the 18th. The barometric readings are reduced to sea level and zero temperature. The highest barometer occurred November 17th, when the record was 30.65. The lowest was 29.70, on the 9th. The highest temperature occurred October 26th, 74°, and the lowest November 18th, 3°.

The self-recording anemometer, from which the wind record is obtained, is exposed to the unobstructed blast as it comes from the prairies and strikes the tower of Washburn College, where the instrument is placed. The velocity of the wind has several times reached 40 miles per hour, and on the 4th was 41 miles part of the day. We have had no gales so violent as occurred in the first part of October, but the total miles traveled by wind has been as great.

	Last 11 days of Oct.	First 10 days of Nov	Second 10 days of Nov.	From Oct 20 to Nov. 20.
TEMPERATURE.				
Min.	32 6	33.4	14.9	27·0
Max.	61.3	54 4	34 1	49.9
Mean.	45.9	43.8	24.8	38.2
Range.	29 9	21.0	19.2	22.4
7 a. m.	36 2	35 1	17.3	29.5
2 p. m.	55.6	49.2	29.1	44.6
9 p. m.	43.1	38.9	18.9	33 6
Mean	44.0	41.5	22 0	35.8
REL. HUMIDITY.				
7 a. m.	.718	.729	.687	.611
2 p. m.	.655	.666	.648	.656
9 p. m.	.698	.683	.679	.687
Mean	.692	.689	.663	.681
PRESSURE, 32° F.				
7 a. m.	30.14	29 94	30 08	30.05
2 p. m.	30.01	29.86	30 24	30.04
9 p. m.	30.01	29 91	30.36	30 09
Mean	30.01	29.90	30.37	30 09
WIND.				
Miles Traveled	3,565	4,127	3,461	11,153
RAINFALL.				
Inches	.....	.....	.....	1.61

EDITORIAL NOTES.

THE October meeting of the Kansas City Academy of Science was largely attended. Dr. Joshua Thorne read a carefully prepared and brilliant essay upon "Intellectual Development," which was followed by an account by Theo. S. Case of an "Excursion to the Birth-place of Montezuma."

The November meeting was also well attended and the audience amply repaid by hearing the third paper of Mr. W. H. Miller upon Herbert Spencer's philosophy, and that of Prof. E. C. Crosby upon the Barometer.

At the December meeting, Col. R. T. Van Horne will read an essay upon the origin of life, under the title of "A New Hypothesis."

THE annual session of the Kansas State Academy of Science was held at Topeka, Kansas, on the 12th, 13th and 14th ult. It was a most interesting and enjoyable meeting in every way, most of the papers read being the results of original investigation, and showing much zeal and research. A full report by Professor J. D. Parker will be found in this number of the *Review*, and it is hoped that most of the papers will be sent us for publication in full.

The Kansas Academy is an honor to the State, and its recommendations should receive the careful attention of the Legislature.

Now that the President of our Academy of Science has been elected to Congress, we may expect that its library will be the recipient of all the valuable publications by the various departments of the Government.

WE are promised the monthly summary of the meteorological observations of the Kansas Weather Service by Prof. Lovewell, of Washburn College, Topeka. They will be made up especially for the *Review*, from the 20th of each month to the 20th of the next, so that we can give our readers, almost to the day of going to press, the results just tabulated from simultaneous observations made all over the State. Hitherto, we have received such a summary from both Professor Snow of Kansas, and Professor Nipher of Missouri; also, from Signal Service Observer C. A. Shaw of Wisconsin; but, as they did not reach us until after our day of publication, they had lost their interest to the general reader before the next issue.

PROFESSOR PRITCHETT, of Morrison Observatory, made us a brief call a few days since. He visited Kansas City to complete arrangements for establishing an electric time ball here.

THE weather of November was exceptionally cold all over the country, but the reports from Colorado were almost incredible. On the 15th, at Denver, the mercury stood at —15° in the morning, and remained below zero all day; at Leadville it reached —25° on the same day, and at Breckenridge —39°, an almost unheard-of thing, for November, especially. In this city, the lowest point reached was 6° above zero, on the morning of the 21st. This is the coldest November weather remembered here since 1857, when the Missouri was frozen over and navigation closed as early as the 20th. However, it lasted less than two weeks, after which the weather was so moderate that no ice was put up, and most of the time it was like April.

THE fall meeting of the National Academy of Science, at New York, was a most successful one. About thirty papers were read by such scientists as Professors Marsh, Langley, Draper, Cope, Gibbs, Agassiz, Barker, Peirce, Rood, etc.

WE are indebted to Principal J. W. Dawson for copies of his recent articles on "The Origin of Man" and "Revision of the Land Snails of the Palæozoic Era," published in the *Princeton Review* and *American Journal of Science*, respectively.

THE State Agricultural College of Kansas is in a more thriving condition than ever before, owing, as we believe, mainly to the influence and efforts of such able and energetic men as President Fairchild, Professors Failyer and Popenoe, and others, who are widely known as able scientists and liberal minded and progressive teachers.

MAJOR B. S. HENNING, well known to all Kansas and Kansas City people, writes from New York to say of the REVIEW that "its success is a great gratification to me, and I want to cheer you on in your good work."

ON November 7th, Mr. Powers, of Lexington, Ind., discovered, in a ravine near Eldorado, Kansas, a shoulder blade and tusk of an unknown monster, supposed, however, from the unusual shape of the latter, to belong not to the mastodon, but to the American elephant.

A SHARP earthquake was experienced in Panama and in Callao, on the 15th Oct., at 9:25 P. M. The shock was heavy. It lasted about eighteen seconds, commencing with a slight trembling and terminating with a motion which frightened every one. No damage was done.

SITKA advices, via Port Townsend, say that the town was visited by a severe cyclone and a heavy shock of an earthquake October 26th.

PROF. R. H. THURSTON, of the Stevens Institute of Technology, says of the REVIEW: "I think the magazine an excellent journal of the class, and admire the manner in which it is conducted."

A LETTER received from Prof. Richard A. Proctor, the distinguished English astronomer, who is now in Australia, states that he will return to England by way of San Francisco and New York, instead of going via the Indian Ocean, as was his previous intention.

XUM

MAJOR J. W. POWELL, Chief of the Bureau of Ethnology, has gone to the Pacific Coast to ascertain in person how this work is progressing. He has eight parties in the field, engaged in making a study of the North American Indians—their condition, their habits of life, their languages, their history, etc., as well as taking a census of them. One of Major Powell's parties has just discovered, in New Mexico and Arizona, a number of old ruins and pueblos. These are now being carefully explored. In New Mexico they have discovered, west of Santa Fe, the largest collection of ruins ever found on this continent.

W. H. SIMPSON, Secretary of the University of Kansas, says: "Our roll now shows 394 students, of whom 15 are from our sister State, Missouri. Never before was the Institution so prosperous and seemingly so thoroughly appreciated by the people generally. We are just beginning to be known and felt."

MR. H. R. HILTON'S able and suggestive paper on The Rainfall in its Relation to Kansas Farming, read before the Kansas Academy of Science last month, is one that should have a wide circulation in those eastern papers that nowadays only publish articles on the arid soil and the famine-stricken people of Western Kansas.

WE have had on our exchange list since its commencement that very interesting and valuable scientific journal, the Kansas City REVIEW, and we take this special occasion for urging upon our western readers the propriety of supporting, by their subscription, a journal that embraces so much interesting material, and is so creditable a medium for the exchange of scientific intelligence.—*New Remedies, Nov.* 1880.

WE have received a copy of Rowell's Newspaper Directory for 1880, and can conscientiously say that, in our judgment, it is the most complete, correct and comprehensive work of the kind ever published in the United States.

THE funeral of the late Prof. J. C. Watson, Astronomer at the Wisconsin University, who died on Nov. 23d, took place at Ann Arbor on the 26th. The will of the deceased astronomer, after providing for his wife and mother, leaves the remainder of his property to the National Academy of Science of the United States. The will further provides that gold medals to the value of one hundred dollars be given to those who shall from time to time make astronomical discoveries, or produce astronomical work worthy of special reward as contributors to science.

PROF. F. V. HAYDEN, the geologist, has just received a cablegram from the president of the Topographical Society of Paris, announcing that the society had conferred on him the grand medal of honor.

THE recent earthquake shocks in British Columbia were very violent. Glaciers were split from base to summit, and great masses cast into the valleys and creeks, completely filling them up.

ITEMS FROM THE PERIODICALS.

SUBSCRIBERS to the REVIEW can obtain any book or periodical published in this country or Great Britain at reduced rates by applying at this office.

THE *Popular Scientific Monthly* for December presents the following choice array of valuable matter: The Development of Political Institutions, and Political Organization in General, by Herbert Spencer. Science and Culture, by Prof. T. H. Huxley, F. R. S. Experiments with the "Jumpers" of Maine, by George M. Beard, M. D. The August Meteors, by W. F. Denning. (Illustrated.) The Early Practice of Medicine by Women, by Prof. H. Carrington Bolton, Ph. D. Methods in Industrial Education, by Prof. S. P. Thompson. The Migrations of Fishes, by Dr. Friedrich Heincke. Domestic Motors. I. Wind and Water Power. By Chas. M. Lungren. (Illustrated.) Indigestion as a Cause of Nervous Depression, by T. Lauder Brunton, M. D., F. R. S. Oriental Music, by S. Austen Pearce, Mus. D., Oxon. The Sabbath, I. By Prof. John Tyndall, F. R. S. Sketch of Professor Dumas, by A. W. Hof-

mann. (With Portrait.) Correspondence. Editor's Table. Literary Notices. Popular Miscellany. Notes.

THE *Journal of the Franklin Institute* completed its one hundred and ninth volume in June, 1880, and is now in the fifty-fifth year of its existence. Under the direction of the Committee on Publication, with its list of able scientists and engineers, as contributors, largely increased, and with the fact that it is the only technological journal published in the United States without any private pecuniary interest, sufficient assurance is given that it will maintain its high position as a leading organ of technology and a standard work of reference. $5 per annum.

THE *American Journal of Science*, now in the twentieth volume of the third series, or the one hundred and twentieth from the commencement, is an acknowledged leader in scientific periodical literature all over the world. The names of its editors, Professors J. D. and E. S. Dana and B. Silliman, are synonyms among all scholars for the highest erudition in scientific lore and the greatest skill in physical investigation and research, while its associate editors, Professors Asa Gray, Josiah P. Cooke and John Trowbridge, of Cambridge, Professors H. A. Newton and A. E. Verrill, of New Haven, and Professor Geo. F. Barker, of Philadelphia, have no superiors in their respective lines of study and exploration. $6 per annum.

THE *Engineering and Mining Journal*, edited by Professors Richard P. Rothwell, C. E., M. E. and R. W. Raymond, Ph. D., and published by the Scientific Publishing Company of New York, is now in its thirtieth volume, and has justly earned the reputation of being the most reliable periodical devoted to these subjects in the country.

PROF. S. N. FELLOWS, of the State University of Iowa, has a short and sensible article in the latest issue of the *National Journal of Education*, upon "Didactics *vs.* Pedagogics," in which he proposes to substitute the former word for the latter in college *curricula*, on the ground that it is euphonious, has a respectable origin and expresses better the meaning that is intended to be conveyed by the term. The Professor has our sympathy in his effort to rid the English language of a barbarous, cacophonous and inexpressive word, and the *Journal of Education* should exercise its usual good taste and correct judgment in aiding the effort.

THE *Western Educational Review* for October contains, as usual, many good and appropriate articles, among which we notice two by Kansas City writers, the first upon Prehistoric Man, by Miss Fanny E. Hall, and the other on The Education of the Judgment, by Prof. E. C. Crosby. The *Review* is well conducted and deserves success.

ACCORDING to the *Monthly Weather Review*, published by the Signal Service Bureau, the verification of weather predictions for October amounted to the very creditable and gratifying percentage of 88.9.

THE *Scientific American* of Oct. 13 contains two full page illustrations of Capt. Eads' proposed railway for transporting ships, with their cargo, across continents. Capt. Eads claims, by his plan, to be able to take loaded ships of the largest tonnage from one ocean to the other across the Isthmus of Panama, as readily as can be done by a canal after the Lesseps plan, and at a much less cost for engineering construction. The project is certainly bold and ingenious, and the projector anticipates no serious difficulties in carrying forward his enterprise. The engravings referred to in the *Scientific American* show the proposed construction of not only the railroad, but the appliances for transferring the ships from the water to the rail.

WE have received the prospectus of *The Platonist*, a monthly periodical, devoted chiefly to the dissemination of the platonic philosophy in all its phases. The editor, Thos. M. Johnson, of Osceola, Mo., is a ripe scholar, who has recently published translations of several of the Treatises of Plotinus, and who possesses an eminently philosophic mind. The subscription price of the *Platonist* is $2 per annum.

XUM

HOUGHTON, Mifflin & Co. publish, besides the *Atlantic Monthly*, of whose excellence we have spoken so often, *Dwight's Journal of Music*, fortnightly, $2.50; the *Boston* (weekly) *Medical Journal*, now in its one hundred and third volume, $5 per annum; the *United States Postal Guide*, monthly, $1.50 per annum; the *Law Reporter*, weekly, $10, and the *American Architect and Building News*—all first-class magazines, and all of which can be had at reduced rates by subscribers to the REVIEW.

THE *Science Observer*, of Boston, now in its third volume, maintains its high standard of excellence in its special department and bids fair to become the organ of the astronomers of this country.

WE have received the December number, being No. 2, vol. 1, of "*Our Little Ones*," an illustrated magazine for children, published monthly at Boston, by the Russell Publishing Co., at $1.50 per annum. The engravings are unsurpassed, the paper and print first-rate, while the fact that "Oliver Optic" is the editor guarantees uniform excellence in the matter. We shall be disappointed if it does not become a leader among the juvenile periodicals.

THE Santa Domingo Congress has passed a decree that, considering the proofs sufficient that the remains found in the cathedral Sept. 10, 1877, are the remains of Christopher Columbus, a monument to enshrine them shall be erected at the capital. All American governments are solicited to contribute to the fund. The government of Santa Domingo gives $10,000.

HARPER'S MAGAZINE, for December, contains the following good things: Christmas Carillons, Annie Chambers Ketchum, with four illustrations by Fredericks; The English Lakes and their Genii, I., M. D. Conway, with fifteen illustrations by E. A. Abbey and Alfred Parsons; Anne, a novel, Constance Fenimore Woo'son, with an illustration by Reinhardt; Fancy Chances, a poem, Rose Aawthorne Lathrop; The Oldest Institution in the World, W. H. Beard, with an illustration by the Author; The Impatient Bird, a poem, Philip O. Sullivan; The City of Pittsburg, G. F. Muller, with nineteen illustrations by Shirlaw; To be Merry, a poem, Robert Herrick, with an illustration by Abbey; The Sixth Year of Quong See, Catharine Baldwin, with six illustrations; The Lucky Horseshoe, a poem, James T. Fields; Looking Back, a poem, H. R. Hudson; Washington Square, a novel, Henry James, Jr.; Editor's Easy Chair; Editor's Literary Record; Editor's Historical Record; Editor's Drawer.

The *American Naturalist*, for December, announces that it has absorbed the *American Entomologist*, and will hereafter have a department in that line with Prof. C. V. Riley as editor. This addition about completes the "Circle of the Sciences" in its comprehensive range of topics and materially increases the value of the *Naturalist* to its scientific readers. Price $4 00 per annum.

THE AMERICAN ANTIQUARIAN

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EDITORS OF DEPARTMENTS.—Early History and Discovery, Prof. R. B Anderson, Madison. Wis.; Anthropological News, E. A. Barber, Philadelphia; Indian Linguistics, A. S. Gatschet, Smithsonian, Washington, D. C.; Mexican Antiquities, Ad. F. Baudelier, Highland, Ill; Biblical Archæology, Rev. Selah Merrill, D. D., Andover, Mass.; Geological Evidences, Prof T. C. Chamberlin, Beloit, Wis.; FOREIGN CONTRIBUTORS Rev. A. H. Sayce, D. D., F. R. S. Oxford, England, on Assyriology; Prof. J. J. A. Steentrup, Stockholm, Denmark, and Prof. Luciano Cordeiro, Lisbon, Portugal.

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